

# Food Technology Abstracts



Central Food Technological Research Institute, Mysore.  
National Information System for Science and Technology  
Department of Scientific and Industrial Research, New Delhi.



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# FOOD TECHNOLOGY ABSTRACTS

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## ABBREVIATIONS

A	ampere
AAS	atomic absorption Spectrometry
abstr.	abstract
ad lib.	ad libitum
ADP	adenosine diphosphate
Anon.	Anonymous
AOAC	Association of Official Analytical Chemists
approx.	approximately
atm	atmosphere
ATP	adenosine triphosphate
$a_w$	water activity
BHA	butylated hydroxyanisole
BHT	butylated hydroxytoluene
BOD	biological oxygen demand
b.p.	boiling point
Btu	British thermal unit
c-	centi- [as in cm, cm <sup>2</sup> , cm <sup>3</sup> ]
cal	calorie
cd	candela
Ci	curie
CMC	carboxymethyl cellulose
COD	chemical oxygen demand
coeff.	coefficient
conc.	concentrated
concn.	concentration
cv.	cultivar
cwt	hundredweight
d-	deci-
DE	dextrose equivalent
detn.	determination
DFD	dark firm dry
diam.	diameter
dil.	dilute
DM	dry matter, Deutsche Mark
DNA	deoxyribonucleic acid(s)
dyn	dyne
E.	East, Eastern, etc
ECD.	electron capture detection
EDTA	ethylenediaminetetra acetic acid
Eh	oxidation-reduction potential
ELISA	enzyme-linked immunosorbent assay
f-	femto-[10 <sup>-15</sup> , as in fCi]
°F	degree Fahrenheit
FAO	Food and Agricultural Organization
FDA	Food and Drug Administration
FID	flame ionization detection
fl oz	fluid ounce
f.p.	freezing point
ft	foot, feet

g	gram
GC	gas chromatography
gn	gravity
gal	gallon
gf	gram-force
GLC	gas-liquid chromatography
h	hour
ha	hectare
HDPE	high density polyethylene
hl	hectolitre [100 l]
hp	horse power
HPLC	high performance/pressure liquid chromatography
HTST	high temperature short time
Hz	hertz [frequency cycle/s]
in	inch
IR	infrared
IU	international unit
J	joule
k-	kilo- [as in kcal, kg]
K	Kelvin
l	litre
lb	pound
lb	pound-force
LDPE	low density polyethylene
m-	milli- [as in mg, ml, mm]
m-equiv	milli-equivalent
m	molar concentration
M-	mega- [as in Mrad]
max.	maximum
min	minute [time]
min.	minimum
mol	mole
mol.wt	molecular weight
m.p.	melting point
MPN	most probable number
MS	mass-spectrometry
n-	nano-[10 <sup>-9</sup> , as in nm]
N	Newton [kg m/s <sup>2</sup> ]
N.	North, Northern, normal concentration
NMR	nuclear magnetic resonance
NPU	net protein utilization
oz	ounce
p-	pico- [10 <sup>-12</sup> , as in pCi]
P	poise
P	probability
Pa	Pascal [N/m <sup>2</sup> ]
PAGE	polyacrylamide gel electrophoresis
PER	protein efficiency ratio
p.p.b.	parts per billion
p.p.m.	parts per million
PSE	pale soft exudative
PTFE	polytetrafluorethylene
PVC	polyvinyl chloride
PVDC	polyvinylidene chloride

qt	quart
R	rontgen
rad	rad or radian
ref.	reference(s)
rev/min	revolutions per minute
RH	relative humidity
RNA	ribonucleic acid(s)
S.	south, Southern, etc.
s.d.	standard deviation
SDS	sodium dedecylsulphate
s.e.	standard error
s	second [time]
SNF	solids-not-fat
sp.,app.	species
sp.gr.	specific gravity
summ.	summary
Suppl.	Supplement
t	metric tonne
temp.	temperature
TLC	thin layer chromatography
TS	total solids
UHT	ultra-high temperature
UV	ultraviolet
V	volt
var.	variety
vol.	volume
v/v	volume/volume
w	watt
W.	West, Western, etc.
WHO	World Health Organization
w/v	weight/volume
wk	week
wt.	weight
yd	yard
yr	year
μ	micro-[as in g, m]
%:	per centum
>	greater than
≥	greater than or equal to;
	not less than
<	less than
≤	less than or equal to;
	not greater than

Chemical symbols are used for all elements.

## ABBREVIATIONS FOR LANGUAGES

### Language of text

Dutch	Nl
French	Fr
German	De
Italian	It
Japanese	Ja
Norwegian	No
spanish	Es
swedish	Sv



## GENERAL

2031

Nakao (Y), Konno (A), Taguchi (T), Tawada (T), Kasai (H), Toda (J), Terasaki (M). **Curdlan: Properties and application to foods.** *Journal of Food Science* 56(3): 1991; 769-772, 776

The effect of high heating temp. (100 - 130 C), heating time (15 - 60 min), curdlan concn. (2 - 6%) and freezing and thawing on gel strength and syneresis of gels of curdlan has been studied. The aqueous suspensions of curdlan, when heated to 100 C or higher, formed a gel, and strength of the gel increased with temp. The gel was stable against freezing and thawing. The syneresis of a 4% curdlan gel after freezing thawing was reduced from 20.6 to 2.1% by additions of 5% waxy corn starch and to 8.9% by additions of 20% sucrose. In practice, it has been conformed that thin-layered gels flavoured with honey or strawberries and Konjac-like gel food could be stored in a frozen state, and noodle-shaped soy milk gel and jellyfish-like gel foods could be retorted. SRA

2032

Navchoo (IA) and Buth (GM). **Ethnobotany of Ladakh, India: Beverages, narcotics, foods.** *Economic Botany* 44(3): 1990; 318-321

The present communication records some of the traditional Ladakhi preparations that has been used for long. Aspects covered include beverages (chhang alcohol beer; and gur gur cha-alcohol salt tea) and foods (khambir-prepared from wheat flour; kholaq-prepared with gur gur cha or with chhang-may be sweet or salty; mok mok-soft, white, non-vegetarian snack; and thukpa-most popular food prepared from several vegetables. AS

2033

Drews (M). **Food innovation to compete on the free markets.** *Ernährungsforschung* 35(4): 1990; 121-127 (De)

Under the conditions of competitive marketing a successful strategy is to differ products from the competitor's goods. Limited change results from the requirements for a natural and therefore healthy food and from the limitations of the buyer to assimilate information. Regarding innovation a check-list of relevant factors to make new products successful is presented and illustrated by an example (semi-fat-butter). AS

## FOOD PROCESSING

2034

Bhowmik (SR) and Shin (S). **Thermal sterilization of conduction-heated foods in plastic cylindrical cans using convective boundary condition.** *Journal of Food Science* 56(3): 1991; 827-830, 842

A mathematical model was developed to evaluate thermal processing of foods in cylindrical plastic cans. This model included convective heat transfer coeff. for heating and cooling media, thermal diffusivities of plastic can wall and the canned food, and contact conductance between the plastic wall and the canned food. Temp. estimated by the model at the coldest point in a can agreed closely with those determined experimentally during thermal processing. Thermal diffusivity of can wall and heat transfer coeff. of heating and cooling media considerably influenced the sterilizing values of the processed food. AS

2035

Patel (PN), Chandarana (DI) and Gavin (AIII). **Internal pressure profile in semi-rigid food packages during thermal processing in steam/air.** *Journal of Food Science* 56(3): 1991; 831-834

Results of this study showed that the internal pressure inside the container increased with increase in headspace volume and product temp. with initial vacuum in a container, the final internal pressure was lower with higher vacuum. The final internal pressure remained unaffected by initial product temp. The predicted internal pressure was not significantly different from experimentally measured internal pressure for water and 3% starch sol. at P less than or equal to 0.01. Hence, this correlation could be used for products similar to 3% starch sol. SRA

2036

Lu (Q), Mulvaney (SJ) and Hsieh (F). **Thermal processes for metal cans compared to retortable plastic containers.** *Journal of Food Science* 56(3): 1991; 835-837

Comparison of critical heating points in metal and plastic cans indicated that the container material significantly influenced the critical heating point of canned products. For the plastic containers, the orientation of the lid during the heating process also influenced the critical heating point which could be more accurately determined using mathematical procedure. The combination of nonsymmetrical external heat transfer and the verifying thermophysical properties of the foods examined indicated that the differences in lethality at the



slowest heating zone in metal and plastic containers could range from 0.5 to 2 min. SRA

## FOOD PACKAGING

### Aseptic packaging

2037

von Bockelmann (B). **Aseptic packaging in the future.** *Journal of the Society of Dairy Technology* 43(3); 1990; 82-83

This article covers product range: highly viscous products, products containing particulates, product sterilization (product sterilization proper, aseptic transfer) aseptic filling of products containing particulates and quality control. BV

### Retort pouches

2038

Gilchrist (JE), Shah (DB), Radle (DC) and Dickerson (RWJr). **Leak detection in flexible retort pouches.** *Journal of Food Protection* 52(6); 1989; 412-415

Retortable flexible pouches now contain sterilized foods, and a method is needed to identify holes in these pouches. The helium leak test and the fluorescence dye test for metal food containers were modified to find micron-sized holes in flexible retort pouches. The helium test and the dye test were about equal in ability to identify holes. The helium test properly identified 32 of 32 pouches with holes. The dye test identified 31 of the same 32 pouches with holes and was able to indicate the point of leakage. Neither method produced a false positive, but the helium test was more sensitive than the dye test or the original biotest. AS

## ENERGY IN FOOD PROCESSING

Nil

## FOOD ENGINEERING AND EQUIPMENT

2039

Liang (B), Shi (Y) and Hartel (RW). **Growth rate dispersion effects on lactose crystal size distributions from a continuous cooling crystallizer.** *Journal of Food Science* 56(3); 1991; 848-854

This study showed that the standard simplification or linear extrapolation, resulted in kinetic expressions that did not represent the entire distribution of crystals. Rather, they were representative of only the fast growing, product sized crystals. A gamma distribution for growth rates modeled the experimental size distributions as well as a distribution composed of two distinct components of growth rate. This sum of two constant rates distribution was simple to use with model and resulted in comparable nucleation and growth rates. This distribution also yielded information on behaviour of slow and fast growers in suspension crystallizers. SRA

2040

Lee (JH) and Singh (RK). **Process parameter effects on particle residence time in a vertical scraped surface heat exchanger.** *Journal of Food Science* 56(3); 1991; 869-870

## FOOD CHEMISTRY AND ANALYSIS

### Chemistry (Analytical)

2041

Kauten (RJ), Maneval (JE) and McCarthy (MJ). **Fast determination of spatially localized volume fractions in emulsions.** *Journal of Food Science* 56(3); 1991; 799-801, 847

A rapid, noninvasive method for determining spatially resolved magnetic resonance (MR) spin-lattice relaxation rates ( $1/T_1$ ) was developed to study the dynamics of emulsions. The technique acquires data simultaneously along the entire emulsion profile. The observed relaxation rates ( $1/T_{1(obs)}$ ) for oil/water emulsions followed the equation:  $1/T_{1(obs)} = (\Phi_{oil}/T_{1(oil)}) + (\Phi_{(water)}/T_{1(water)})$  where  $\Phi_{(oil)} + \Phi_{(water)} = 1$ . Volume fractions along the profile of a 40% (v/v) oil/water emulsions were calculated for several times during creaming to establish dynamics of the process. Separation velocities calculated from such profiles may be used to test (or correct) predictions of models for creaming emulsions. AS

2042

Winkler (M), McCarthy (MJ) and German (JB). **Noninvasive measurement of lipid and water in food using magnetic resonance imaging.** *Journal of Food Science* 56(3); 1991; 811-815



Kapfer (G-F), Berger (RG) and Drawert (F). Improved production of 4-decanolide by biomass recirculation. *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2): 1991; 1-3

During a semicontinuous fermentation of *Tryomyces sambuceus* (130 days) the production of 4-decanolide was optimized up to a concn. of 1.535 mgL<sup>-1</sup>. Coupling filtration with fermentation on subsequent days, the fermentation broth was circulated through a tubular filter system back in to the reactor. The filtrate was substituted by fresh medium. The recirculation of biomass enhanced the productivity of 4-decanolide in averaging 23 mg.L<sup>-1</sup>.h<sup>-1</sup>. A maximal growth rate of 2.5 g.L<sup>-1</sup>.d<sup>-1</sup> was reached. AS

## Bacteria

2046

Hutton (MT), Koskinen (MA) and Hanlin (JH). Interacting effects of pH and NaCl on heat resistance of bacterial spores. *Journal of Food Science* 56(3): 1991; 821-822

Results of this study illustrates the effect of heating menstruum pH and the NaCl content of the recovery medium on the D values of PA3679 and *Clostridium botulinum* 213B spores. When the pH of the heating menstruum was decreased, regardless of NaCl content of the recovery medium, the spore D value was reduced. Spores PA3679 heated in pH 7.0 buffer were twice as heat resistant as the same spores heated in pH 5.0 buffer. Addition of NaCl to the recovery medium reduced the number of colony forming units in a population of heated spores. Presence of NaCl at 2.0% in the recovery medium decreased the spore D-value by 20-40% irrespective of pH of the heating menstruum. Combined effect of pH and NaCl could be illustrated by 3-dimensional histograms. SRA

## Bacillus subtilis

2047

Thoroski (J), Blank (G) and Billaderis (C). Eugenol induced inhibition of extracellular enzyme production by *Bacillus subtilis*. *Journal of Food Protection* 52(6): 1989; 399-403

Eugenol, the major essential oil of clove, in sublethal concn. (0.02 - 0.03%, v/v) inhibited the production of  $\alpha$ -amylase, protease, and subtilisin by *Bacillus subtilis* in lab. media. Microscopic observation revealed that at these eugenol concn., *B. subtilis* cells appeared swollen and distorted and/or appeared as very long and thin filaments (> 100  $\mu$ m).

## Fermented foods

### Idli

2043

Soni (SK) and Sandhu (DK). Microbial prevalence and succession associated with idli fermentation. *Indian Journal of Microbiology* 31(2): 1991; 169-174

The microbial load and their types were determined in 35 traditionally fermented idli batter samples at different stages of fermentation collected from local market in Amritsar city Punjab, India during summer and winter along with the lab. prepared batter. All samples were positive for bacteria while yeasts were present in 24 samples. *Leuconostoc mesenteroides* was the most prevalent followed by *Lactobacillus fermentum*, *Streptococcus faecalis* and *Pedococcus cerevisiae*, *Saccharomyces cerevisiae* and *Debaryomyces hansenii* were the most predominant yeasts followed by *Hansenula anomala* and *Trichosporon belgellii*. Bacteria and yeasts increased significantly with the progress in fermentation. Summer was the most favourable season for bacteria and winter for yeasts. SRA

## Microorganisms

2044

Scott (VN). Interaction of factors to control microbial spoilage of refrigerated foods. *Journal of Food Protection* 52(6): 1989; 431-435

A var. of factors can prevent growth of microorganisms. Combining inhibitory factors can result in considerable improvement in the microbial stability of foods. Suitable combinations of growth-limiting factors at subinhibitory levels can be devised so that certain microorganisms can no longer proliferate in the product (the hurdles concept). Knowledge of the effectiveness of a wide range of combinations of hurdles for a var. of microorganisms would be valuable in product development in allowing predictions of microbial stability and safety of new formulations. Data generated in the lab. could be used to predict the effect that changing certain factors would have relative to other factors with regard to increasing or decreasing microbial stability. These types of predictions are particularly important with refrigerated foods since the storage temp. is frequently the primary hurdle, and temp. abuse is not uncommon. AS



Of 20 amino acids investigated, only L-glutamic or L-aspartic acid ( $> 5.0$  mg/ml) prevented such morphogenic distortions when added to eugenol-containing media before inoculation. Addition of these amino acids also resulted in an increase in biomass and protease production. In contrast, the addition of serine ( $> 1.0$  mg/ml) enhanced filamentous growth but reduced the production of protease and subtilisin. AS

2048

Okada (N), Akimoto (T) and Manabe (M). **Comparison between amino acid marker and DNA base marker in cell fusion of *Bacillus subtilis*.** *Report of the National Food Research Institute (Japan)* 54(2): 1990: 29-34 (Ja)

Detection conditions of fusants in bacterial fusion are unfavourable, because two adverse factors exist in a protoplast reversion medium: poor nutrients and low water activity. Suitable detection media were constructed for both amino acid-negative mutants and DNA base-negative mutants. Frequency of colony forming number and regeneration of protoplasts were higher when mutants with DNA base marker were used than when those with amino acid marker were used. However, fusion frequency was somewhat high when mutants with amino acid marker were used. The present detection media and methods will be applicable for both mutants in one's possession. AS

#### ***Listeria monocytogenes***

2049

Harris (LJ), Daeschel (MA), Stiles (ME) and Klaenhammer (TR). **Antimicrobial activity of lactic acid bacteria against *Listeria monocytogenes*.** *Journal of Food Protection* 52(6): 1989: 384-387

Fourteen bacteriocin-producing strains from the genera *Lactobacillus*, *Leuconostoc*, *Pediococcus*, and *Lactococcus* were evaluated for their ability to inhibit the growth of 8 strains of *Listeria monocytogenes*. 7 strains of lactic acid bacteria were antagonistic toward *L. monocytogenes* by deferred antagonism testing on agar. Cell-free supernatants from cultures of 3 of the 7 bacteriocin-producing strains which inhibited growth of *L. monocytogenes* in deferred antagonism testing also inhibited growth in well diffusion assays. The 8 strains of *L. monocytogenes* were identical in their sensitivity or resistance to bacteriocins. The action of the bacteriocins was eliminated by proteolytic enzymes. AS

2050

Sorrells (KM) and Enigl (DC). **Effect of pH, acidulant, sodium chloride and temperature on the growth of *Listeria monocytogenes*.** *Journal of Food Safety* 11(1): 1990: 31-37

Growth of 2 *Listeria monocytogenes* strains in tryptic soy broth containing NaCl or combinations of NaCl and acidulants at different pHs and temp. was investigated. *L. monocytogenes* was capable of growing in 10% NaCl at 35 C and 12% NaCl at 25 and 10 C. The max. NaCl for growth changed when NaCl and pH, in combination with different acidulants and temp., were tested. The min pH/salt level for initiation of growth of *L. monocytogenes* ranged from 5.0 - 5.6/8 - 10% at 35 and 25 C and 5.6/8% at 10 C, depending upon the acidulant and the strain. Greatest antimicrobial activity occurred at 35 C. Greatest survival occurred at 10 C. In this study *L. monocytogenes* appeared to persist and tolerate a combination of low pH, high salt and low temp. AS

#### ***Salmonella***

2051

Dickson (JS). **Enumeration of *Salmonellae* by most-probable-number using the *Salmonella* 1-2 test.** *Journal of Food Protection* 52(6): 1989: 388-391

A rapid *Salmonella* identification test was substituted for the selective plating and identification steps in the standard cultural most-probable-number procedure. The modified procedure was evaluated using a mixed culture of 4 salmonellae sp. inoculated into ground beef. The rapid test kit was inoculated from both the pre-enrichment and selective enrichment steps in the standard procedure. There were fewer false negatives when the test kits were inoculated from selective vs. non-selective broths. However, there were no false negatives when the kit was inoculated from Rappaport-Vassiliadis' broth, after pre-enrichment in lactose broth. Use of the test kit in the MPN procedure produced acceptable results in 48 to 72 h, compared with 96 to 120 h for the standard procedure. AS

#### **Fungi**

2052

Afe (EO) and Oso (BA). **Amylolytic activities of culture filtrates of *Rhizopus oryzae* and *Botryodiplodia theobromae*.** *Journal of Food Science and Technology (India)* 28(2): 1991: 110-111

The amylolytic activities of culture filtrates of *B. theobromae* and *R. oryzae* were determined. Peak amylase production was indicated on the 3rd day for



*R. oryzae* and 5th day for *B. theobromae*. Max. activity of amylase for both organisms was recorded at pH 4. There was a near doubling of amylolytic activity of culture filtrates with a doubling of the concn. of starch in growth media for both organisms. Increase in amounts of starch in growth media resulted in progressive increase in the dry water of mycelia. *R. oryzae* produced amylases on glucose, starch, carboxymethyl cellulose and pepper extract media while *B. theobromae* produced amylases on starch and pepper extract media only. AS

### Aspergillus niger

2053

Shantha (T) and Rati (ER). Isolation and characterization of an aflatoxin-inhibiting metabolite from *A. niger*. *Current Science* 59(6): 1990; 326-327

The factor from *Aspergillus niger* that inhibits aflatoxin production by *A. flavus* was purified from culture broth and identified as oxalic acid. The inhibition was verified by using authentic samples of oxalic acid. AS

### Mushrooms

2054

Eder (J) and Wunsch (A). Studies on the protein quality of oyster mushrooms (*Pleurotus spp.*). *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2): 1991; 25-29

A study was carried out to determine the N and protein contents, as well as protein comp. of oyster mushrooms. The total N content was 3.4% in dry matter, 5.8% free amino acids, 47.7% protein and the remainder by other nitrogenous substances. The protein was comparable to animal protein. The essential amino acid indexes range over 85. BV

### Yeasts

2055

Werkhoff (P), Bretschneider (W), Emberger (R), Guntert (M), Hopp (R), Kopsel (M). Recent developments in the sulphur flavour chemistry of yeast extracts. *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2): 1991; 30-57

The volatile flavour components from yeast extracts were isolated by means of the simultaneous distillation/extraction method according to Likens-Nickerson. The flavour conc. was pre-separated by medium pressure liquid chromatography on silica gel using a pentane-diethyl ether gradient and subsequently

analyzed by high resolution capillary GC and combined GC/MS. Identifications were focused on sulphur-containing constituents. Unknown flavour components were isolated by preparative capillary gas chromatography in µg amounts for IR and <sup>1</sup>H-NMR spectroscopic investigations. In total 115 sulphur-containing flavour components were positively identified for the first time in yeast extracts. The compounds identified were aliphatic sulphur-containing components, hemidithioacetals, sulphur-substituted furans, thiophenes, thiazoles, 3-thiazolines, five- and six-membered cyclic polysulphides, C<sub>9</sub>-C<sub>12</sub>-alkyl-substituted perhydro-1,3,5-dithiazines (thialdines), bicyclic perhydro-1,3,5-dithiazines as well as 2,4,6-trimethylperhydro-1,3,5-oxathiazine and 2,4,6-trimethylperhydro-1,3,5-thiadiazine. In most cases, the structures of newly identified components were confirmed by organic syntheses. Their occurrence, formation pathways, sensory properties, and spectroscopic data are discussed in detail. AS

### Hygiene

2056

Zottola (EA) and Smith (LB). The microbiology of foodborne disease outbreaks. An update. *Journal of Food Safety* 11(1): 1990; 13-29

This review covers terminology, (foodborne disease or illness (food intoxication or true food poisoning, food infections and food toxicoinfections), parasitic infections, chem. food poisoning, viral food infections), sources, bacterial contamination, chem. contamination, viral infections, control and/or prevention, economic impact. 37 references. BV

## BIOTECHNOLOGY

Nil

## TISSUE CULTURE

Nil

## FOOD ADDITIVES

2057

Samant (SK) and Pai (JS). Cyclodextrins: New versatile food additive. *Indian Food Packer* 45(3): 1991; 55-65



Cyclodextrins are speciality chemicals obtained from enzymatic hydrolysis of starch. They possess the property of encapsulating other smaller hydrophobic molecules thus forming complexes. These complexes are quite stable and can be used for changing or modifying and/or masking the effect of encapsulated (guest) molecule. These cyclodextrins are considered food additives exhibiting a wide range of applications. The paper covers aspects like chemistry of cyclodextrins; their complexes; toxicological aspects; production process and their applications in stabilization of food flavours, elimination of unpleasant taste or odour, emulsion stabilization, retention of nutritional quality of food, controlling or masking colour, sweetness improver and such other things. VKR

2058

Ohashi (S), Ura (F), Ochi (T), Iida (H) and Ukai (S). **Interaction of thaumatin with carrageenans. I. Effects of pH, temperature and competing cations.** *Food Hydrocolloids* 4(2): 1990; 105-119

The effect of temp. and pH on the interaction of thaumatin with carrageenans were examined by turbidity (absorbance) measurements. The max. ratio of thaumatin reacting with carrageenans correlated with pH, increasing particularly at pH greater than or equal to 5. The sweetness intensity of thaumatin-carrageenan complexes was markedly reduced at pH 3 - 4, and aduced to a lesser extent at pH greater than or equal to 5. There was also a temp. effect, with a change in absorbance at 60 C greatly different from that at 20 C. When  $\text{Na}^+$ ,  $\text{K}^+$  and  $\text{Ca}^{2+}$  were added to screen the negative charge of the carrageenans, there was no interaction with thaumatin. Since turbidity disappeared when these cations were added to suspensions of the thaumatin- $\lambda$ -carrageenan complex, it was assumed that thaumatin interacts with carrageenan via electrostatic bonding. AS

#### Colourants

2059

Roy (AK) and Chakrabarti (J). **Added colours in foodstuffs from Calcutta market.** *Science and Culture* 57(1/2): 1991; 40-41

To explore the frequency of occurrence of added colouring matter on some foodstuffs sold in and around Calcutta markets, a short term comprehensive survey was undertaken. The % of samples with added colour was in sweet-meats 90, flattened rice 45.8, cereal and pulse products 21.3, confectionery 17.2, fish 16.1, vegetables 15, cut fruits 14.8, milk and milk products 14, velpuri 10, turmeric powder 6.7 and egg 5.7. The permitted colouring matter added did not exceed the

prescribed limit. Metanil yellow, orange II, rhodamine B, auramine, Congo red, malachite green and copper sulphate are non-permitted colours identified. SRA

#### Dye

2060

Sudhir Singh, Khanna (SK) and Mathur (BN). **Toxicological evaluation of permitted food colours. Part I. Azo dyes (red).** *Indian Dairyman* 43(8): 1991; 363-368

The author summarises the short term and long term studies conducted with amaranth, carmoisine (C.I. Food Red 3), Fast Red E (C.I. Food Red 4) and Ponceau 4 R (C.I. Food Red 7). Long term studies conducted with rat and mouse using amaranth indicated no toxicity. No adverse effect was seen with carmoisine when fed to rats upto dietary level of 1.0% for 90 days. Carmoisine at 6% or greater showed only reduction in body wt. but no toxicity. The ADI limit for man of Ponceau 4 R could be upto 0.15 mg/kg body wt. SRA

#### Emulsifiers

2061

Patino (JMR), Feria (JF) and Herrera (CG). **Food emulsifier monolayers.** *Grasas y Aceites* 41(2): 1990; 179-189 (Es)

The formation of food emulsifier monolayers on the air-water interfaces and its relationship with the emulsification process are considered. Relationship among formation of condensed monolayers, lipid associations, and structural characteristics of monolayers that help the emulsification process, are discussed. The emulsions stabilized by an interfacial film and the compressibility of these monolayers are revised as applications of results of studies on food emulsifiers. AS

#### Sweeteners

2062

Matysiak (NL) and Noble (AC). **Comparison of temporal perception of fruitiness in model systems sweetened with aspartame, an aspartame + acesulfame K blend, or sucrose.** *Journal of Food Science* 56(3): 1991; 823-826

The temporal perception of fruitiness of equisweet solutions of sucrose(s), aspartame (APM) and blend of APM and acesulfame K (AK) in binary system (sweetener and orange flavour) and a tertiary system (sweetener, orange flavour and acid) has been compared, and interactions between fruitiness and



sweetness in these systems are explored. Results indicate that in orange-flavoured binary and tertiary model systems, the 60:40 APM + AK blend had durations of both sweetness and fruitiness similar to 8. In contrast, although equally sweet at max. intensity, APM significantly extended persistence of fruitiness and sweetness longer than S or APM + AK. SRA

## CEREALS

2063

Bakhshi (AK) and Dhingra (DP). **Scope of cereal based food processing industry in Punjab.** *Indian Miller* 21(6); 1991; 15-19

The cereal based food processing industry of Punjab is mainly based on wheat, paddy and maize. Among these the breakfast and snack foods (chapatis, parathas, puris) of wheat, flaked rice, expanded rice and puffed rice and roti, porridge and sattv from maize, sorghum, pearl millet and finger millet could find good market in Punjab. Bulgar wheat porridge, semolina and ready-to-eat cereals like flakes, shredded biscuits and pretzels, barley malt, tortillas, corn, nuts and popcorns will also have good prospects in Punjab. SRA

2064

Katlyar (SK) and Bhatia (AK). **Essential amino acids profile in eight traditional cereal cultivars of trans-Himalayan region.** *Journal of Food Science and Technology (India)* 28(2); 1991; 126-127

Proximate and amino acid comp. of 8 traditionally cultivated var. of pseudocereals and cereals viz. *Amaranthus polygamus*, *Fagopyrum esculentum*, *Eleusine coracana*, *Hordeum vulgare*, *Panicum miliare*, *Paspalum scrobiculatum*, *Setaria verticillata*, and *Triticum vulgare* of trans-Himalayan region were chemically evaluated. The proteins of all the cereals are well balanced with respect to their essential amino acid contents. The quantities are comparable to the known standard var. of rice and wheat. Pseudocereals (*A. polygamus* and *F. esculentum*) possess better amino acids profile with high lysine contents of 4.4 and 4.7 g/100 g protein resp. AS

2065

Holz (R). **Two way gravity separator in hulling industry.** *Getreide-Mehl und Brot* 44(9); 1990; 263-265 (De)

## Barleys

2066

Schwank U, Jacot A, Drawert R, and Fischer G. **A half kernel method for determination of the amylose content of barley.** *Starch Science* 42(3); 1990; 66-69 (De)

A method, which can determine the amylose content of a single kernel, is of importance for the use of amylose mutants in plant breeding. In this paper a potentiometric titration for the detn. of the amylose content of a matured half-kernel of barley is described and the evaluation of the titration-curves is discussed. This method allows to differentiate between various barley lines and var. in genotypes which differ in amylose content. AS

## Oat

2067

Vorwerck (K). **Oat milled products with increased content of dietary fibre.** *Getreide-Mehl und Brot* 44(9); 1990; 265-266 (De)

## Rice

2068

Sowbhagya (CM) and Zakluddin Ali (S). **Effect of presoaking and cooking time and texture of raw and parboiled rice.** *Journal of Food Science and Technology (India)* 28(2); 1991; 76-80

Milled raw rice ('IR 20', 2 yr old) needed about 15 min to cook in excess boiling water. Parboiled rice (normal-, pressure-, roasted-, parboiled) required longer time (21 to 32 min) for cooking depending upon parboiling condition. Cooked parboiled rice was however shorter (2-10%) in length, but thicker (15-20%), more firm (about 5%) and considerably more elastic (15-20%) than cooked raw rice. Presoaking at room temp. for 15 min of raw and 2 to 3 h of parboiled rice reduced the cooking time by 50% for raw and 25-40% for parboiled rice as compared to unsoaked controls. Presoaking of raw rice caused an increase in the length (about 20%) of cooked raw rice but a reduction in thickness (about 5%), firmness (about 10%) and elasticity (about 25%) as compared to unsoaked cooked control. Presoaking of parboiled rice did not significantly change these parameters. AS

2069

Ohtsubo (K), Siscar (JJH), Juliano (BO), Iwasaki (T) and Yokoo (M). **Comparative study of texturometer and Instron texture measurements on cooked Japanese milled rices.** *Report of the National Food Research Institute (Japan)* 54(2); 1990; 1-9



A comparison of texture measurements of cooked rice was undertaken with a Texturometer at the National Food Research Institute and with an Instron Food Tester at the International Rice Research Institute on the 1986 crop of 29 Japanese rices. Texturometer hardness but not adhesiveness of cooked rice correlated with amylose content. On the other hand, both Instron hardness and stickiness correlated with the amylose content. Koshihikari which gives low hardness and high stickiness values was characterized by the markedly low hardness/stickiness ratio both with the Instron and the Texturometer method. Both values of stickiness and hardness/stickiness by the Instron method and of adhesiveness and hardness/adhesiveness by the Texturometer "cooker method" correlated significantly with water uptake ratio and expanded volume on cooking, and the former values also correlated with iodine blue value of cooking liquid. Cooking time correlated negatively with alkali spreading value. The Texturometer differentiated adhesiveness of samples better than hardness, while the reverse was true for the Instron method. AS

2070

Bhattacharya (KR). **Need for widening the scope of rice breeding in India for the purpose of table rice.** *Oryza* 26(2); 1989; 117-122

Rice var. differ greatly in their cooking and eating qualities; specific eating qualities of rice are attributable to identifiable chem. criteria that differ among var. Eating quality of rice is also modified by its age and by processing, such as parboiling. But varietal characteristics interact strongly with processing and age. Thus by judicious selection of a var. combined with appropriate processing and age, one can cater to a wide range of quality requirements of rice. Breeders should keep these factors in mind in rice breeding in addition to agronomic factors. On this basis, there is a need to breed both very high- and also low- and intermediate-amylose var. for specific purposes, in addition to normal high-amylose rice common in India. AS

#### Rice bran

2071

Takano (K), Kamo (K) and Obara (T). **Purification and properties of rice bran phosphatidate phosphatase. Studies on the mechanism of lipids hydrolysing in rice bran. Part VII.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(4); 1990; 261-265 (Ja)

Phosphatidate phosphatase (EC 3.1.3.4) extracted from rice bran was purified 222 fold with a yield of 5.2% by ammonium sulphate precipitation and column chromatographies on decylamin-Sepharose, DEAE-cellulose, chromatofocusing and TOYOPEARL HW-55 F. The mol. wt. and the isoelectric point of the enzyme were estimated to be 280 000 and 5.3, resp. The enzyme showed optimum pH of 5.0 and optimum temp. of 60 C. The enzyme activity increased 1.6 fold with addition 10 mM  $\text{Ca}^{2+}$  and was inhibited by  $\text{Ni}^{2+}$ ,  $\text{Mg}^{2+}$  and PCMB. The enzyme was stable over the pH range of 3.0 - 8.0 and below 40 C. The  $K_m$  of the enzyme for phosphatidic acid was estimated to be  $1.25 \times 10^{-3}$  M. AS

#### Rice flour

2072

Yilmaki (G), Hawrysh (ZJ), Hardin (RT) and Thomson (ABR). **Response surface methodology in the development of rice flour yeast breads: Sensory evaluation.** *Journal of Food Science* 56(3); 1991; 751-755, 759

The aim of this study was to develop gluten-free rice flour yeast breads comparable to wheat flour (white) breads in appearance, odour, flavour, texture and aftertaste, using response surface methodology (RSM) and sensory evaluation. The development of formulations for rice breads comparable to wheat bread in sensory quality was dependent on type of rice flour and levels of carboxymethylcellulose (CMC), hydroxypropylmethylcellulose (HPMC), and water resulted in rice breads with moistness, cohesiveness, yeasty flavour, adhesiveness, aftertaste, top crust colour, crumb colour, cell size uniformity and predominant cell size comparable to a reference (REF) wheat bread. Rice breads made from medium grain rice flours, and specific HPMC, CMC and water combinations, met more sensory REF standards than rice breads made from long grain rice flour. SRA

#### Ryes

2073

Mano (Y), Ohnishi (M), Sato (H), Nakanishi (H), Maemoto (M), Ito (S). **Compositions of lipid classes, fatty acids and sterols in domestic rye grains.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(5); 1990; 338-345 (Ja)

Total lipids were extracted from 4 var. of domestic rye grains, and their lipid class comp., the component fatty acids and sterols were investigated. The yields of the total lipids were 1.6 - 1.9%. The neutral lipid fraction usually amounted to about



70% of the whole, in which triacylglycerol was predominant. The ratio of the glycolipid and phospholipid fractions was approx. 1:1.4, the principal lipid classes were diglycosyldiacylglycerol, monoglycosyldiacylglycerol and cerebroside in the former group, and phosphatidylcholine, phosphatidylethanolamine, phosphatidylinositol and lysophosphatidylcholine in the latter one. The main fatty acids in 9 lipid classes were generally linoleic, palmitic, oleic and linolenic acids in the decreasing order, except for acylsterol, in which the most abundant one was palmitic acid. The relative proportions of linoleic acid were 55 - 60% in triacylglycerol, 65 - 79% in two glyceroglycolipids and 41 - 68% in phospholipid classes. Seven types of 4-desmethylsterols were detected, among which sitosterol and campesterol, particularly the former one, were predominant in neutral and polar sterol lipids. No significant differences were recognized in the chem. comp. of the rye grain lipids among the var. harvested in Hokkaido, Japan. AS

## Wheat

2074

Hira (CK), Anita Kochhar, Sadana (BK) and Sharma (KK). **Protein, lysine, mineral and phenol contents of some Indian wheat (*Triticum aestivum* L.) varieties.** *Journal of Food Science and Technology (India)* 28(2): 1991: 112-113

Nineteen wheat var. were analysed for crude protein, available lysine, Ca, P, phytate, polyphenols, trace elements and ionizable Fe. Mean values for crude protein and available lysine were 11.7% and 2.43 g/16 gN, resp. Mean phytin P, phenols, Fe, ionizable Fe, Mn, Cu and Zn were 214, 217, 8.2, 3.1, 4.6, 0.65 and 4.25 mg/100 g, resp. Protein content was not found to be associated with phytate or phenol content. AS

2075

Gerstenkorn (P) and Seibel (W). **Processing value of new durum wheat cultivars.** *Getreide-Mehl und Brot* 44(9): 1990: 259-262 (De)

## Wheat flour

2076

Sawant (BP), Bhuihar (BW), Surve (VD), Spare (DB) and Kanawade (LR). **Effect of premilling moisture content on selected characteristics of wheat flour.** *Indian Miller* 21(6): 1991: 29-31

The influence of premilling moisture content on fineness modulus, av. particle size and uniformity index of wheat flour milled in plate mill and hammer mill was evaluated. Wheat var. 'HD 2189' (*Triticum*

*aestivum*) was conditioned with water at room temp. to get moisture content of 12 to 27.10%. Coarse samples were fed on standard sieve set (3, 6, 8, 14, 28, 48 and 100 mesh). After shaking for 5 min, the material retained on each sieve was weighed. Results showed that fineness modulus increased with increase in moisture content: the increase was from 2.34 to 3.15 in plate mill and from 2.02 to 2.48 in hammer mill corresponding to increase in moisture content from 12.00 to 27.10%. The uniformity index ranged from 0.5:5 to 0.8:2 in plate mill and 0.3:7 to 0.6:4 in hammer mill with increase in moisture content. There was no coarse fraction in the comminuted product. The relative proportion of medium fraction increased with moisture content in both the mills. SRA

2077

Haridas Rao (P) and Hema Malini Rao. **Effect of incorporating wheat bran on the rheological characteristics and breadmaking quality of flour.** *Journal of Food Science and Technology (India)* 28(2): 1991: 92-97

Water absorption capacity (WAC) determined in farinograph increased from 59 to 67% with increase in the bran level upto 20% while further increase in its level gradually decreased the WAC to 63%. However, when determined in mixograph or 'Research' water absorption meter (RWAM), the same increased gradually upto 40% level of bran incorporation, but the extent of increase was much higher in the mixograph. The WAC of flour containing 40% bran indicated in mixograph and RWAM were 79.6% and 62% resp. The WAC determined in mixograph was nearer to the bakery water absorption. Incorporation of bran adversely affected the texture, grain and loaf volume of bread but improved the aroma depending on the level used. The max. level of bran that could be used to obtain the acceptable quality high-fibre bread was found to be 30%. The quality was improved by using the following additives: 0.5% guar gum; 0.5% sodium steryl lactylate; 3.0% gluten; 15 p.p.m. potassium bromate and 60 p.p.m. ascorbic acid. Sponge and dough method of breadmaking was found to be better than the straight dough method. The volume of bread thus made increased to 510 ml from 415 ml observed for control. AS

## Wheat products

### Chapaties

2078

Sohan Pal (DP), Saini (SK), Malik (SK) and Gautam (PL). **Effect of Karnal bunt on grain quality components and chapati making quality.** *Indian Miller* 21(6): 1991: 23-26



Wheat var. 'UP 262', released for cultivation in Eastern region, has got resistance to rusts and leaf blight and possesses amber hard bold grains with good chapathi making quality. Healthy, partially and fully Karnal bunt infected grains were separated out and 8 infection levels (1 to 7 and 10%) were made on wt. basis from partially and fully infected grains. 15 treatments were given in washed and unwashed category. Duplicate samples of each of 30 treatments were analysed for grain wt., protein content, Pelshenke value (PV), sedimentation value, flour recovery and chapati making properties. The results indicated that in partially infected grains the PV was slightly increased upto 5% infection, but at 7 and 10% infection the value was lower in the washed treatment. The protein content, sedimentation value and flour recovery did not show much difference at different levels of infection. The chapati making qualities was acceptable upto 4% partial and full Karnal bunt infection. By washing partially infected grains the chapati upto 7% infection was acceptable. In fully infected grains washing led to acceptability of chapati upto 5% level. In general, washing the infected grains improved the acceptability of chapati at lower levels of infection. At 10% infection the chapati was totally unacceptable. SRA

2079

Sidhu (JS), Seibel (W) and Rabe (E). **Effect of whole wheat flour milling procedure and bran addition on the instrumental texture of chapaties.** *Getreide-Mehl und Brot* 44(9); 1990; 279-281 (De)

## MILLETS

### Corn

2080

Camire (ME) and King (CC). **Protein and fiber supplementation effects on extruded cornmeal snack quality.** *Journal of Food Science* 56(3); 1991; 760-763, 768

The effects of added protein and fiber in extruded corn curl type products was determined and the effects of two sources of insoluble and soluble fiber on various food quality characteristics was evaluated. Results showed that cotton linter cellulose and soy cotyledon fiber used at 10% wt. replacement for corn meal appeared to have minimal impact on many physical characteristics of extruded corn snacks. The use of soy protein isolate at 15% replacement caused increased expansion, a darker colour, and less corny flavour. Hence, lower levels of this material should be used when a product

similar to the corn meal-only product is desired. SRA

2081

Suzuki (K), Maeda (T), Matsuoka (K) and Kubota (K). **Effects of constituent concentration on rheological properties of corn oil-in-water emulsions.** *Journal of Food Science* 56(3); 1991; 796-798, 854

Rheological properties were studied with a tube viscometer. Emulsifying agents were soy lecithin and Tween 20. The volume concn. of dispersed phase,  $\Phi$ , ranged from 0.32 - 0.62. The emulsions behave as pseudoplastic fluids. The flow behaviour index,  $n$ , of the lecithin emulsions increased slightly with increasing  $\Phi$  and concn. of emulsifying agent,  $C_e$ . However, the  $n$  values of Tween 20 emulsions were nearly constant. Apparent viscosity of the emulsions increased with increase of  $\Phi$  and  $C_e$ . With  $\Phi$  constant the apparent viscosity was still strongly affected by  $C_e$ . AS

2082

Lee (YJ) and Hagler (WMJr). **Aflatoxin and cyclopiazonic acid production by *Aspergillus flavus* isolated from contaminated maize.** *Journal of Food Science* 56(3); 1991; 871-872

Seven truck-loads of maize were tested for mycotoxin contamination. Aflatoxin was identified in all 7 at concn. from 3 ng/g-501 ng/g (aflatoxin B<sub>1</sub> + B<sub>2</sub>). Cyclopiazonic acid was identified in 4 loads with concn. from 25 -250 ng/g. Deoxynivalenol was found in 4 of 5 loads tested, over a range of 46 - 676 ng/g. 19 isolates of *Aspergillus flavus* from the samples were tested for ability to accumulate cyclopiazonic acid and aflatoxin in liquid culture. 14 produced cyclopiazonic acid (0.5 - 135 µg/mL), 12 produced aflatoxin (0.01 - 0.70 µg/mL, aflatoxin B<sub>1</sub> + B<sub>2</sub>), and one aflatoxin-producing isolate did not produce cyclopiazonic acid. AS

### Sorghum

2083

Kiuchi (K), Takami (I), Sindou (S), Yamamoto (K) and Morie (K). **Development of sweet sorghum silage starter.** *Report of the National Food Research Institute (Japan)* 54(2); 1990; 44-52 (Ja)

Lactic acid productive bacteria were isolated for the preparation of sweet sorghum (*Sorghum bicolor*) silages. Lactic acid production was investigated in sweet sorghum juice medium with the isolates and lactic acid bacteria preserved in the lab. 17 strains produced more than 2 mg/ml D- or L-lactic acid. Sweet sorghum silage was prepared with the



addition of the vegetative cells of lactic acid bacteria, and in the three treatments more than 80 of the Frieg's point was obtained. The added strains KTE2-9 and KTB2-13 which contributed for the preparation of excellent sweet sorghum silages were identified *Lactobacillus plantarum* (Orla-Jensen) Bergey et al. and the strain KTG4-4 was *Streptococcus faecalis* Andrews and Horder. During the preparation the Frieg's point increased by 7 days but decreased between one to two months. AS

### Sweet sorghum

2084

Krishaveni (S), Balasubramanian (T) and Sadasivam (S). **Potentiality of sweet sorghum (*Sorghum bicolor*, Poaceae) for syrup preparation and alcohol production in India.** *Economic Botany* 44(3); 1990; 355-359

Thirty-eight cultures of sweet sorghum (*Sorghum bicolor*, Poaceae) at dead-ripe stage showed that the cultures IS 8962, IS 9889, PR 4579 and IS 707 contained higher amounts of total sugars/100 ml of extractable juice. But total sugar yield was found to be high (> 200 kg/ha) in IS 715, IS 724, IS 8962 and IS 9901. Though upper internodes contained comparatively higher sugar content than the bottom internodes, the 7th internode had the max. A highly positive correlation (+0.9828) was found to exist between total sugars and sucrose in the internodes. Fermentation of juice from IS 8962 yielded 240 l of alcohol/ha. Roasted chickpea candies prepared from syrup of 73 degree Brix resembled that from jaggery in taste and flavour. AS

### PULSES

2085

Nagaraja Kumari (N) and Pattabiraman (TN). **Natural plant enzyme inhibitors: Protease inhibitors in *Canavalia* seeds.** *Journal of Food Science and Technology (India)* 28(2); 1991; 105-107

Nine var. of seeds belonging to the *Canavalia* sp. tested, were found to inhibit bovine trypsin and  $\alpha$ -chymotrypsin activities. Ratios of antitryptic to antichymotryptic activity varied from 0.92 to 12.5. Chromatographic studies on Sephadex G-100 indicated that the inhibitors have mol. wt. around 11.0 kDa. All the seed extracts showed very weak action against the proteolytic activity of human pancreatic preparation. The action on bovine pancreatic extract was 13.6 to 26.6 times more based on the linear range of inhibition. The seed extracts did not cause more than 35% inhibition of the proteolytic activity of human pancreatic extract even at high concn. of the inhibitor protein. AS

2086

Bera (MB), Mukherjee (S), Singh (RN) and Gaurang (M). **Studies on cooking rate equation of dhal.** *Journal of Food Science and Technology (India)* 25(1); 1991; 114-115

The cooking mechanism of dhals of pigeon pea and chick pea was investigated in terms of rate equations using cooking core model. The rate equations involve two parameters, the reaction rate parameter of the dhal component with water and diffusion rate parameter of water. The results showed that the cooking rate was mainly limited by reaction rate of the dhal components with water at 98 C. The radius of uncooked core decreased as the time of cooking increased. AS

### Broad beans

2087

Zheng (B-A), Matsumura (Y) and Mori (T). **Thermal gelation mechanism of legumin from broad beans.** *Journal of Food Science* 56(3); 1991; 722-725

The legumin formed a gel through formation of soluble aggregates and their juncture. Electron microscope studies indicated the legumin molecules associated to form strands. These strands then formed network-like structures, finally resulting in gel formation. The thickness of those strands and network constituents was irregular (8.3 - 36 nm). A presumed process of thermal legumin gelation was hypothesized. A comparison of gelation behaviours in legumin and in glycinin was also studied. AS

### Chickpeas

2088

Paredes-Lopez (O), Ordorica-Falomir (C) and Olivares-Vazquez (MR). **Chickpea protein isolates: Physicochemical, functional and nutritional characterization.** *Journal of Food Science* 56(3); 1991; 726-729

Proteins were isolated from chickpea flour by micellization and isoelectric precipitation techniques. Protein content ranged from 84.8 - 87.8%. Denaturation temp. and transition enthalpy, by differential scanning calorimetry, were higher for micelle than for isoelectric proteins. Sodium dodecyl sulphate-polyacrylamide gel electrophoresis showed a mol. wt. distribution between 16.6 - 66.4 kD for micelle and 14.9 - 84.2 kD for isoelectric proteins. Most functional properties compared favourably to a commercial soy isolate. In general, most essential amino acids of chickpea isolates were at acceptable levels



compared to a reference pattern. High values of *in vitro* digestibility and calculated PER were obtained for the isolates. AS

### Green beans

2089

Zhang (Q), Cavalieri (RP), Powers (JR) and Wu (J). **Measurement of lipoxygenase activity in homogenized green bean tissue.** *Journal of Food Science* 56(3); 1991; 719-721, 742

A rapid assay for lipoxygenase activity in homogenized vegetable tissue has been developed, and method was verified using fresh green beans. Lipoxygenase activity of homogenized fresh vegetables could be quantified by this rapid assay without enzyme purification. The assay procedure required about 2 min. Effect of endogenous substrate is negligible on enzyme activity detn.  $K_m$  value, pH optimum, and rate of thermal inactivation of lipoxygenase were measured in macerated green bean seed samples and compared with published reports. Assay conditions, including pH, ionic strength and buffer reagents concn., must be properly controlled. This assay may allow processors to use lipoxygenase activity as a control parameter to optimise blanching operations for products where lipoxygenase is the causative enzyme in off-flavour development. SRA

### Mung beans

2090

Archana Rathore and Misra (N). **Fungitoxicity of four oxidiazol thione derivatives towards fungi deteriorating moong (*Phaseolus aureus* Roxb.) seeds.** *Journal of Food Science and Technology (India)* 28(2); 1991; 128-130

Four new organic compounds viz., 3-(3,4 Dimethyl amino methyl)-5- (1-4 methoxy phenyl) -1, 3, 4-oxadiazol-2 thione; 3- (3, 4-Dichlorophenyl amino methyl) -5- (2-4-dichlorophenoxy methyl) -1, 3, 4-oxadiazol-2-thione; Bis (5-p-methoxy phenyl-1,3,4-oxadiazolyl-2) disulphide; 5-p-methoxy phenyl-2-mercapto 1,3,4-thiadiazole were tested for fungitoxicity against *Aspergillus flavus* LK., *A. fumigatus* (Eidam) Wint., *A. parasiticus* Speare, *Cladosporium oxysporum* Bark and Curt, *Fusarium moniliforme* Sheldon and *Penicillium citrinum* Thom at 1% concn. Compound 3-(3,4 Dimethyl amino methyl -5- 4-methoxy phenyl)-1, 3,4-oxidiazole-2 thione was non-toxic to moong plants (*Phaseolus aureus* Roxb.). It also checked the appearance of fungi on the seeds in storage. AS

### Redgram

2091

Bhuibhar (BW), Sawant (BP), Andhare (VK) and Kadu (AB). **A study on instantisation of redgram dhal:** *Journal of Food Science and Technology (India)* 28(2); 1991; 84-85

Drying time of cooked dhal was found to be decreasing with increase in drying air temp. Rehydration percentage of dehydrated dhal, dried at 80 C was found to be higher than that dried at 60 and 70 C. Percentage reduction in cooking time for instant dhal was 80 to 84%, when recooked in boiling water. Instant dhal dried at 60 C was found to be most acceptable with respect to colour, texture, taste and odour. AS

2092

Usha Kumari and Reddy (NS). **Recovery of dhal from redgram stored under different conditions.** *Journal of Food Science and Technology (India)* 28(2); 1991; 116-117

Dhal (dehusked split grains) recovery from redgram (*Cajanus cajan*) grains treated with protectants like dried neem leaves, cow dung ash (1.0%) and mustard oil (0.5%) and stored for 4 months in tin containers and clay pots was studied. The per cent dhal recovery improved in samples treated with dried neem leaves and mustard oil and stored for 4 months in tin containers. Highest recovery was (80.8%) in mustard oil treated sample and the lowest (68.6%) was in cow dung ash treated sample. Mustard oil and dried neem leaves treated samples were not infested whereas cow dung ash treated samples showed 61.5% damage due to insect infestation. There was a negative correlation at 5% level of significance. AS

### OILSEEDS AND NUTS

#### Coconuts

#### Chutneys

2093

Satyanarayana Rao (TS), Kaverappa (NM) and Hema Prakash Reddy (T). **Dehydrated coconut chutney.** *Journal of Food Science and Technology (India)* 28(2); 1991; 73-75

This paper presents the method of preparation, dehydration (hot air drying technique), preservation and reconstitution of coconut chutney and their storage behaviour (physical and chemical changes)



at different temp. Dehydrated chutney reconstitutes well in cold water and had all the characteristics of fresh chutney. The product could be stored for 3 months at 37 C and for 6 months at ambient temp. when packed in flexible pouches. BV

## Copra

2094

Mercado (CJ), Real (MPN) and Del Rosario (RR). **Chemical detoxification of aflatoxin-containing copra.** *Journal of Food Science* 56(3): 1991: 733-735

Aflatoxin-containing copra at moisture contents of 24% and 7% was effectively detoxified by ammonium hydroxide (>97% and 89% reduction, resp.). Detoxification was accomplished in 5 days using 1.5% ammonium hydroxide (ammonia/copra); in 10 days using 1.0% and in 15 days using 0.5%. The initial aflatoxin B<sub>1</sub> concn. of 500 p.p.b. (9% moisture) was reduced to less than or equal to 20 p.p.b. Detoxification trials using a screw expeller showed 67% reduction in aflatoxin content of the oil with 1.0% ammonia. AS

## Cottonseeds

2095

Abdel-Rahim (EA), Naguib (KM), Badawi (MM), Ibrahim (MMK) and Guergues (SN). **Biochemical studies on the fate of aflatoxins contaminated cottonseed after treatment with ammonium hydroxide.** *Grasas y Aceites* 41(2): 1990: 144-148

Treatment of contaminated cottonseed cake with NH<sub>4</sub>OH caused detoxification of aflatoxins found in all contaminated samples. Detoxification rate for aflatoxin B<sub>1</sub> was higher than that of B<sub>2</sub> and G<sub>2</sub> at very low concn. (0.1% ammonium hydroxide). The rate of detoxification of all aflatoxins increased with increasing ammonium hydroxide concn. up to 0.4%, then decreased with further increase of NH<sub>4</sub>OH concn. Increasing NH<sub>4</sub>OH to 14% destroyed completely all the tested aflatoxins. Aflatoxins mutagenicity test (Ames test, sensitivity test and brine/shrimp test) confirmed the chem. detn. obtained by fluorescence methods. AS

## Mustard seeds

2096

Aguilar (CA) and Zeigler (GR). **Effect of temperature and electrolytes on the viscosity of aqueous dispersions of mustard seed (*Sinapsis alba*) mucilage.** *Food Hydrocolloids* 4(2): 1990: 161-166

The effect of temp. and electrolytes on the viscosity of dilute dispersions of yellow mustard (*Sinapsis*

*alba*) mucilage have been investigated. Mustard mucilage behaved as a polymeric electrolyte. Excessive heating reduced dispersion viscosity, as did an electrolytic solution of 0.5% NaCl and 2.4% acetic acid. AS

## Soybeans

2097

Asano (M), Okubo (K) and Yamauchi (F). **Effect of hot water immersing on behaviour of undesirable taste components from different parts (seed coat, hypocotyl and cotyledon) in soybean.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kagyo Gakkaishi)* 37(5): 1990: 375-379 (Ja)

Soybean seeds were separated into seed coat, hypocotyl and cotyledon to estimate the removal efficiency of its undesirable taste in hot water soaking. The max. extraction was from hypocotyl and was 53% of the control (hypocotyl extract with 70% (EtOH)). Therefore the hot water soaking seemed to be a simple and effective way to reduce the undesirable taste without dehulling and dehypocotylling process. TLC and HPLC pattern of hypocotyl extracts (70% EtOH and hot water soaking) indicate large amount of saponin A group (saponin Aa, Ab) which have stronger undesirable taste. Further, more unidentified components (U1 and U2) along with saponin Aa and Ab were extracted in hot water soaking. The unidentified component U1 was found to be glycitein 7-β-O glycoside and U2 to be daidzin using TLC and HPLC after fractionation by Sephadex LH-20 gel permeation chromatography. BHSR

## Soy products

2098

Mishra (P), Usha (MS) and Surjan Singh. **Soy-wheat flour blends: Chemical, rheological and baking characteristics.** *Journal of Food Science and Technology (India)* 28(2): 1991: 89-91

Blending with defatted soy flour at levels of 2, 4, 6, 8 and 10% in 2 wheat var. ('UP 319' and 'RR-21') was studied for its effect on bread making qualities. The protein, total ash, Ca, and P contents increased in the blends and sedimentation values decreased marginally at higher levels of blending. Mixing time increased as the level of defatted soy flour increased upto 10%. In the alveograms, the height of curve (tenacity) increased with blending level. The extensibility of dough decreased inversely with defatted soy flour level. Loaf volume of bread decreased when soy flour level increased beyond 2%. AS



## Soy milk

2099

Omura (Y) and Takechi (H). **Effect of hot water treatment on flavour of soy milk.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(4): 1990: 278-280 (Ja)

The production of soy milk reduced in beany flavour was investigated through a treatment process in hot water. After soaking, hulled soybeans were immersed in hot water adjusted to 70 C for 5 min before grinding. By this treatment, the content of n-hexanal in soy milk was reduced to 1% of that in untreated one and, as a result, almost no beany flavour was felt organoleptically. Further, the recovery of the solid of the soy milk was about 90% of that of the untreated one. Under the hot water treatment conditions, among the enzymes participating in beany flavour, lipoxygenase retained its activity but hydroperoxide lyase was almost inactivated. AS

2100

Kawai (H), Takato (S) and Kaneshi (T). **Proximate compositions and contents of minerals, linoleic acid and tocopherols in soy milks.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(4): 1990: 293-297

## Soy sauces

2101

Miyashiro (R). **Purification and properties of stevioside hydrolysing enzyme from raw soy sauce. Utilization of stevia sweetener on soy sauce. Part III.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(5): 1990: 369-374 (Ja)

A stevioside hydrolyzing enzyme was purified from raw soy sauce by a series of column chromatography and found to be homogenous on polyacrylamide gel electrophoresis. The mol. wt. estimated by gel filtration and SDS-PAGE were 184 000 and 90 000, resp., suggesting that the enzyme consisted of 2 identical subunits. The optimum pH for the enzyme was about 5.0, being stable below 5.0 at 4 C for 18 h. The optimum temp. was about 55 C, being stable up to 50 C for 10 min. The enzyme activity was inhibited by AgNO<sub>3</sub>, CuCl<sub>2</sub>, PbCl<sub>2</sub>, HgCl<sub>2</sub>, FeCl<sub>2</sub>, AlCl<sub>3</sub>, SDS and p-chloromercuribenzoate. Specificity studies for substrates indicated that the enzyme was specific for  $\beta$ -configuration of sugars and preferred  $\beta$ -1, 2 glucosidic linkage, suggesting that the enzyme was  $\beta$ -glucosidase ( $\beta$ -D-glucoside glucosylhydrolase, EC 3.2.1.21). The apparent

Michaelis constant of the purified enzyme was 9.71 mM for stevioside. AS

## Soy proteins

2102

O'Keefe (SF), Resurreccion (AP), Wilson (LA) and Murphy (PA). **Temperature effect on binding of volatile flavour compounds to soy protein in aqueous model systems.** *Journal of Food Science* 56(3): 1991: 802-806

Use of head space technique to determine the thermodynamic parameters for binding of a series of aldehydes, ketones, alcohols and hexane to purified soybean glycinin and  $\beta$ -conglycinin has been studied. Study showed that there were limitations in the technique at high and low temp. Hydrophobicity data indicated a difference in binding of the hydrophobic probe at 5 C and 20 C, suggesting structural changes that could alter the strength or number of sites. The number of binding sites were higher for glycinin than  $\beta$ -conglycinin and binding constants were higher for glycinin at 20 and 30 C. SRA

2103

Nishiya (T), Tamaki (K), Kageyama (R), Tatsumi (K) and Ido (K). **Reduction of off-flavours in commercial soy protein isolate (SPI) by fermentation.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(4): 1990: 243-247

The three microorganisms *Saccharomyces cerevisiae*, *Torulopsis holmii* and *Aspergillus niger* significantly decreased beany flavours (hexanal, hexanol and 1-octen-3-ol) of commercial SPI and increased the preferable fermented flavours (diacetyl and acetoin) which closely resemble those of fresh cheese. Protein hydrolysis occurred during fermentation when SPI was treated with *T. holmii* and *A. niger*. The results indicate that the fermented SPIs can be used without flavour problems as major protein source for a wide variety of imitation dairy products. BV

## TUBERS AND VEGETABLES

### Beet molasses

2104

Roukas (T). **Production of citric acid from beet molasses by immobilized cells of *Aspergillus niger*.** *Journal of Food Science* 56(3): 1991: 878-880



Results of this study showed two important aspects of citric acid production from beet molasses by *Aspergillus niger* cells entrapped in Ca alginate gel beads. Shaking culture was a better fermentation system for production of citric acid (35 g/L, 28 days) than the bioreactor. Immobilised *A. niger* cells retained their activity to produce citric acid for a long time (84 days) during repeated batch fermentations. SRA

## Potatoes

2105

Zhang (WB), Addis (PB) and Krick (TP). **Quantification of 5 $\alpha$ -cholestane-3 $\beta$ ,5,6 $\beta$ -triol and other cholesterol oxidation products in fast food French fried potatoes.** *Journal of Food Science* 56(3): 1991: 716-718

Concerns about toxicity of cholesterol oxidation products (COPS) prompted this study. Two restaurants were selected which use animal-vegetable (A/V) shortening for deep-frying. The survey of COPS for 30 days indicated values for total COPS in French fried potatoes were 20 plus or minus 9 p.p.m. - 24 plus or minus 6 p.p.m. 5 $\alpha$ -Cholestane-3 $\beta$ ,5,6 $\beta$ -triol (triol) was identified in French fried potatoes from one restaurant. The mean for triol was 9 plus or minus 3 p.p.m. Triol, 7 $\alpha$ -hydroxycholesterol, 7 $\beta$ -hydroxycholesterol and 7-ketocholesterol were confirmed by co-chromatography and mass spectrometry. Triol is one of the most potent of angiotoxic COPS. This and other studies suggested French fried potatoes and other deep-fried foods cooked in A/V shortening are a major source of COPS. AS

## Sweet potatoes

2106

Wu (JQ), Schwartz (SJ) and Carroll (DE). **Chemical, physical and sensory stabilities of prebaked frozen sweet potatoes.** *Journal of Food Science* 56(3): 1991: 710-713

The shelf stability of baked whole sweet potatoes during frozen storage has been investigated, the effect of curing and storage on product quality is determined, and acceptability of microwave-heated frozen prebaked sweet potatoes has been evaluated after 0, 1, 3, 6 and 9 months. Results indicate that baked frozen sweet potatoes from all treatments were stable during 6 months frozen storage, with exception of vitamin C, which decreased by about 50% during first month. Sensory scores showed that the potatoes were acceptable. SRA

2107

Mervat (RJ), Attendak (KF), Dahi (GG), Chapman (CW) and Hays (SJ). **Volatile constituents and sugars of three diverse cultivars of sweet potatoes [*Ipomoea batatas* (L.) Lam.].** *Journal of Food Science* 56(3): 1991: 714-715, 742

Qualitative and quantitative differences in sugars and volatile constituents of two sweet potato cvs ('Jewel', Tainung 57) and are breeding line (no 99) displaying a diverse range in flavour has been studied. The investigation showed substantial variation between existing sweet potato cvs in both volatile constituents of the baked roots and concn. and ratios of specific sugars. 21 compounds consisting of aldehydes, ketones, furans, pyridine, alcohols, terpenes and palmitic acid were identified. Maltose, sucrose, glucose and fructose were isolated and identified by GLC. Only quantitative difference were found in concn. of total sugars. Maltose, the principal sugar formed during cooking, ranged from 0.07% in the breeding line No. 99 to 5.3% in Tainung 57. SRA

## Cucumbers

2108

McFeeters (RF) and Fleming (HP). **pH effect on calcium inhibition of softening of cucumber mesocarp tissue.** *Journal of Food Science* 56(3): 1991: 730-732, 735

The first-order rate of softening of cucumber tissue containing 1.5M NaCl with and without 20 mM added Ca ion was determined from pH 2.5 - 8.0 at 74 C. Ca ion had little inhibitory effect on rate of softening when pH was above 5. Below pH 5 the relative effectiveness of Ca in reducing rate of softening increased as pH decreased. This behaviour was opposite to that expected if Ca inhibited softening by cross-linking negatively charged pectin carboxyl groups. This was more evidence against that mechanism as an explanation for inhibition of softening by Ca ion in plant tissues. A very large decrease in rate of tissue softening was observed at alkaline pH whether or not Ca was added. AS

## Jerusalem-artichoke

2109

Seiler (GJ). **Protein and mineral concentrations in tubers of selected genotypes of wild and cultivated Jerusalem-artichoke [*Helianthus tuberosus*, Asteraceae].** *Economic Botany* 44(3): 1990: 322-335

In this study the protein, N, P, K, Ca, Mg, Na, Fe, Mn, Zn and Cu concn. of tubers of nine wild and 10



cultivated genotypes of Jerusalem-artichoke at different stages of maturity are determined, and the study has shown that both the varieties appear to contain adequate protein and minerals to contribute significantly towards a nutritionally balanced diet. One protein content is comparable to or higher than that of other root type crops. Adequate macromineral concn. of Ca, Mg, P, and K were present, while Na had a higher concn. Trace elements (Mn, Zn and Cu) were present in adequate amounts compared to other root-type crops. SRA

## Leafy vegetables

### **Amaranthus paniculatus**

2110

Singhal (RS) and Kulkarni (PR). **Studies on applicability of *Amaranthus paniculatus* (Rajgeera) starch for custard preparation.** *Starch/Starke* 42(3): 1990; 102-103

*A. paniculatus* or Rajgeera has been shown to contain 50 - 60% of waxy starch, having an extremely small granule size of 1 - 2  $\mu$ m, and higher paste viscosity than corn starch. Studies on utilisation of Rajgeera starch for custard preparations showed it to be unsuitable for such purpose because of interactions among the various ingredients used in the formulation. AS

## Broccoli

2111

Brackett (RE). **Changes in the microflora of packaged fresh *Broccoli*.** *Journal of Food Quality* 12(3): 1989; 169-181

Changes in the microflora of fresh broccoli shrink-wrapped in film, sealed in gas-flushed film pouches, or stored on ice in cardboard crates and held at 1 C were analyzed. Growth trends for total aerobes, psychrotrophs, yeast/molds, members of Enterobacteriaceae, and lactic acid bacteria did not differ significantly between the packaging treatments (P less than or equal to 0.05). However, populations of total aerobes in unpackaged broccoli in its final wk of storage (wk 6) were significantly greater than that of packaged broccoli at wk 6. Samples packaged in film remained higher in quality 2 to 3 wks longer than control samples. Yellowing was the most obvious defect. AS

## Tomato

2112

Vijay Sethi. **Effect of addition of spice extracts and flavouring compounds on the keeping quality of tomato juice stored in different containers.** *Indian Food Packer* 45(3): 1991; 17-18

Tomato juice with salt (1%), sugar (2%), chillies (0.05%), citric acid (0.03%), malt vinegar (3.3%) was preserved with 200 p.p.m. sodium benzoate + 400 p.p.m. potassium metabisulphite, and was fortified with ginger juice (0.5%), aqueous curry leaf extract (0.5%), eugenol (0.01%) cinnamaldehyde (0.01%), soluble essence of lemon (0.04%) and spiced flavourings. It was packed in glass bottles, PVC and high density plastic bottles, and stored for one yr. at room temp. (28-38 C) and at low temp. (1-3 C). Stored juice was analysed periodically for Brix (TSS), pH, acidity, non-enzymatic browning and lycopene. Retention of lycopene showed better with soluble essence of lemon but non-enzymatic browning was more during storage. Glass bottles were found better than PVC and high density plastic bottles in lycopene retention, sensory quality, physical and chem. changes and shelf-life of juice during storage. Tomato juice was liked more with curry leaf extract followed by eugenol and could be exploited on commercial basis. At low temp. glass and plastic containers were found equally good. In PVC bottles juice preserved as such spoiled after 9 months while eugenol or cinnamaldehyde fortified juice did not spoil upto 1 yr at 28-38 C. VKR

2113

Holmes (BJ), Medeiros (LC), Russell (WC) and Maki (LR). **Verification of USDA home-canning recommendations for tomatoes processed at high altitudes.** *Journal of Food Science* 56(3): 1991; 736-738

Survivability of spoilage bacteria in tomatoes home-preserved at high altitude was studied. Thermal-processing followed USDA guidelines for two elevations (1540m and 2150m) and two process methods (boiling water-bath and pressure). Three treatments of *Bacillus coagulans* spores (no added spores,  $10^4$  and  $10^5$  spores/jar) were used. Processing method, elevation or inoculum level had no effect on post-processing count (P > 0.05), but over all treatment groups, surviving bacteria were found in 19.4% of the jars. Even though tomatoes processed upto 2150m elevation were verified as safe, detectable surviving bacteria in some jars indicated processing guidelines were minimal. AS



## FRUITS

2114

Kulkarni (DK), Kumbhojkar (MS), Agte (VV), Joshi (NS) and Joshi (VN). **Nutrient content in *Flacourtia* from Western Maharashtra.** *Journal of Food Science and Technology (India)* 28(2): 1991: 118-119

It is observed on fresh wt. basis that the ripe fruits of *F. montana* has 1.08 g % proteins, 17.21 g % carbohydrates, 1.59 g % fats, 232 mg % Ca, 10.6 mg % P and 38 mg % tannic acid. Corresponding values for *F. latifolia* were 2.13 g %, 22.86 g %, 2.98 g %, 144 mg %, 19.7 mg % and 31 mg % resp. Unripe fruits showed marked differences in the contents of Ca and P. Presence of Fe in very low quantities and vitamin C in traces in all the stages of estimations are noteworthy. AS

### Apples

2115

Nayital (RK) and Chopra (SK). **Maturity indices in relation to length of storage in 'Red Delicious' apple (*Malus domestica*).** *Indian Journal of Agricultural Sciences* 61(6): 1991: 400-403

Optimum harvest time for 'Red Delicious' apple grown under high hill (2200 m above sea level) conditions of Himachal Pradesh (India) was computed by harvesting at different dates after full flowering and determining various chem. parameters soon after harvest and after 180 days of storage at 0 plus or minus 1 C, 85-90% RH. Fruit firmness, seed colour, total soluble solids (TSS), titratable acidity, bio-electrical conductance, starch iodine test, and sensory tests were carried out. Results indicated that pickings made at 130 plus or minus 2 days from full bloom was optimum when the fruits had a pressure rating of 8.22 Kg, with TSS content of 12.27%, starch index of 5, and seed colour rating of 6. After 180 days of cold storage at plus or minus 1 C, the fruits harvested on 128 or 132 days after full bloom possessed optimum dessert quality, and gave highest sensory evaluation scores. SRA

2116

Drake (SR), Baranowski (JD) and Williams (MW). **Response of 'Top Red Delicious' apples to daminozide.** *Journal of Food Quality* 12(3): 1989: 193-202

Daminozide was applied at 2.2, 4.5, 6.7 or 9.0 kg/ha to 'Top Red Delicious' apple trees 86 days after full bloom the first yr and at 2.2, 3.4 or 4.5 kg/ha, 80 days after full bloom the second yr. At commercial

harvest, after 2 and 4 months regular cold storage and after 6 and 10 months of controlled atm. (CA) storage apples were evaluated for CO<sub>2</sub> ethylene production, flesh firmness, external colour, soluble solids, acids, subjective appearance and daminozide residue. Ethylene production was reduced as daminozide application was increased. Delay in onset of the climacteric ranged from 3 to 21 days depending on chem. rate used. Firmness, red colour, acids, subjective appearance and number of days to reach climacteric were significantly improved by all rates of daminozide. Quality differences due to daminozide were evident following both types of storage. Daminozide residues were directly related to rate and did not dissipate during storage. There was no detectable daminozide carry-over in fruit from yr to yr. AS

2117

Sharma (RC), Joshi (VK), Chauhan (SK), Chopra (SK) and Lal (BB). **Application of osmosis-osmo-canning of apple rings.** *Journal of Food Science and Technology (India)* 28(2): 1991: 86-88

Different dip treatments before canning for various periods of time in hypertonic solution of sugar (70%) resulted in wt. loss, sugar penetration and increase in shrinkage of the apple rings. Cut-out analysis for various parameters of the canned rings revealed that the pre-treatment in 70% sugar solution at 50 C for half an h prior to canning was adjudged to be the best treatment from physico-chemical, sensory and economic points of view, among the treatments tried. The application of this technique resulted in the products of desired drained wt., colour and appearance, texture and sugar-acid-blend compared to those canned as per conventional canning technology. The pre-treatment technique being simple, cheap without involving extra equipment is commercially feasible. AS

### Grapes

2118

Lamikanra (O) and Lamikanra (VT). **Muscadine grape seed oils.** *Journal of Food Quality* 12(3): 1989: 183-191

Dichloromethane soluble constituents of seeds from 'Welder', 'Regale' and 'Carlos' muscadine grape cv were analyzed with a combined GC-MS. 5 components of the extracts, which constituted 10-13% of the seed wt. were separated. Stearic acid, glyceryl monostyrate and a stearic acid derivative were identified as the constituents of 4 of the separated peaks. Glyceryl monostyrate content of the extracted oils for 'Carlos', 'Regale' and 'Welder' cv were 94.1, 89.4 and 72.7% resp., while their



stearic acid contents ranged from 5.6% in 'Carlos' to 8.9% in 'Regale'. Qualitative and quantitative differences between muscadine grape seed oils and those of non-muscadine cv are also discussed. AS

## Peaches

2119

Javeri (H), Toledo (R) and Wicker (L). **Vacuum infusion of citrus pectinmethylesterase and calcium effects on firmness of peaches.** *Journal of Food Science* 56(3); 1991; 739-742

Vacuum infiltration of Majestic peaches (*Prunus persica*) for 1 h with a solution of Marsh grapefruit pectinmethylesterase (PME) containing 100 mg/L CaCl<sub>2</sub> significantly increased firmness of canned peaches. Mean firmness of peaches infused 2 h and thermally processed was 13.9 J/kg as compared to 3.2 J/kg for noninfused, processed controls. The Ca content increased from 278 to 432 mg/kg during 2 h infusion of blanched peaches. Specific activity of PME in peach halves increased more than 20 fold after infusion. AS

## Pineapples

2120

Kollmannsberger (H), Nitz (S) and Drawert (F). **Determination of non-natural flavour in sparkling fruit wines. 3. Enantiomeric  $\gamma$ -lactones in pineapple and pineapple products.** *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2); 1991; 58-63 (De)

Enantiomeric distribution of chiral  $\gamma$ -lactones in fresh pineapple fruits and pineapple products was determined by multidimensional gas chromatography - mass spectrometry (MDGC-MS) on a chiral column (Lipodex B).  $\gamma$ -hexa-(90-280 p.p.b) and  $\gamma$ -octalactone (40-190 p.p.b) dominate quantitatively in the fresh fruits. While  $\gamma$ -hexalactone may occur as a racemate (R:55-75%), all other investigated lactones ( $\gamma$ -octalactone as well as the minor compounds  $\gamma$ -hepta-,  $\gamma$ -nona-,  $\gamma$ -deca- and  $\gamma$ -dodecalactone) are mainly R-configured (80-100%). The share of  $\gamma$ -hexalactone in pineapple products is distinctly higher than in fresh fruits. Both,  $\gamma$ -hexalactone (R:36-46%) and  $\gamma$ -octalactone (R:52-76%) may occur racemic in conc. Additional flavour compounds, useful for the evaluation of adulterations in sparkling fruit wines containing pineapple, are discussed. AS

## CONFECTIONERY, STARCH AND SUGAR

### Confectionery

## Chocolates

2121

Ziegler (G). **A rapid method for the quality control of milk chocolate by HPLC.** *Deutsche Lebensmittel-Rundschau* 86(10); 1990; 311-313 (De)

Water vapour distillates of milk chocolates are analyzed by means of HPLC combined with diode array and UV-detector. Stored samples of milk chocolate develop a characteristic HPLC-peak, which is associated with 3,5-octadien-2-ones. The concn. of these compounds correlates with the organoleptically found staled taste. The method seems suited and of interest for industrial quality inspection. AS

## Starch

2122

Maroulis (ZB), Shah (KK) and Saravacos (GD). **Thermal conductivity of gelatinized starches.** *Journal of Food Science* 56(3); 1991; 773-776

Investigation was carried out to obtain accurate values of thermal conductivity (k) of gelatinized high-amylose and high-amylopectin starches in the moisture range 50 - 80% (1-4 kg water/kg dry solids). Starches were gelatinized at 120 C. Similar k values which varied from 0.434 to 0.548 W/mK in the temp. range 30 - 70 C were obtained for both starch gels. Experimental data were fitted to 6 structural models, representing various geometries for mixtures of water and dry starch. The thermal conductivity of gelatinized starches, determined by heated probe method, increased significantly with moisture content and temp. The perpendicular model yielded the best predictions from structural models tested. The predicted thermal conductivity of dry gelatinized starch ( $k_s$ ) increased linearly with temp T(k) according to equation:  $k_s = 0.210 + 0.410 \times 10^{-3}T$ , W/mK. SRA

2123

Lorenz (K). **Quinoa (*Chenopodium quinoa*) starch - physico-chemical properties and functional characteristics.** *Starch/Starke* 42(3); 1990; 81-86

Starch was isolated from quinoa (*Chenopodium quinoa*) for a study of physico-chemical properties, functional characteristics and a comparison with starches from wheat, barley, wild rice, amaranth and potatoes. Quinoa starch granules range in size from 0.6 - 2.0  $\mu$ m and are found within the cells of the seed as single entities or as compound structures of spherical or oblong aggregates. Quinoa starch exhibited a higher Amylograph



viscosity, a greater waterbinding capacity and a greater swelling power compared to wheat- or barley starch. The gelatinization temp. range of quinoa starch was slightly higher than that of wheat- or barley starch. Amylose content was lower. As a thickening agent for fillings, quinoa starch performed better than other starches in the study. However, breads and cakes baked with quinoa starch were of poor quality. Volumes were lower, the grain non-uniform with thick cell walls and the texture dense and compact. The overall performance of quinoa starch in baked goods was similar to that of other non-cereal starches (amaranth- and potato starch). AS

2124

Deffenbaugh (LB) and Walker (CE). **Use of the rapid visco-analyzer to measure starch pasting properties. Part II. Effects of emulsifiers and sugar-emulsifier interactions.** *Starch/Starke* 42(3): 1990: 89-95

The Rapid Visco-Analyzer (RVA) was used to study the effects of sucrose ester (SE) emulsifiers and a propylene glycol ester (PGE) emulsifier on starch cooking properties. Maize, tapioca and wheat starches were affected to different degrees by F-160 SE with a hydrophil-lipophil balance (HLB) of 15. Up to a concn. of 0.05 parts emulsifier to 1 part starch, the F-160 SE increased peak viscosity, time to peak and max. setback viscosity of the starches. These data suggested that the SE functioned by forming a clathrate complex with the starch molecules. When cooking properties of maize starch were studied in the presence of SEs with HLB 6, 11 and 15, the effects of the SE did not appear to be directly related to HLB. The PGE did not appear to form a clathrate complex with wheat starch, as indicated by a decrease in peak viscosity and time to peak. Cooking properties of the starches were also measured in the presence of sugars (dextrose, sucrose, corn syrup solids and polydextrose) at a level of 2 parts sugar to 1 part starch, plus emulsifiers at a ratio of 0.02:1. Peak viscosity, time to peak and max. setback viscosity were affected synergistically in the presence of both sugar and emulsifier as compared to additive effects of the two ingredients acting alone. Although reaction mechanisms could not be defined from the data obtained, the RVA proved useful for quickly demonstrating the effects of multiple ingredients on starch cooking properties. AS

## Sugar

2125

Hosea (TJC), Ng (SC) and Oates (CG). **A Brillouin scattering study of the glass transition in sucrose.** *Food Hydrocolloids* 4(2): 1990: 137-147

The Brillouin laser light scattering spectra of aqueous sucrose solutions have been measured as a function of temp. through the glass transition region. The Brillouin shift and width, which are proportional to the velocity and attenuation of sound waves in the system, resp., both exhibit marked changes in their temp. coeff. near the glass transition temp. of a sucrose solution containing 30% w/w water. Phase separation behaviour has also been observed in the sucrose solutions. AS

## BAKERY PRODUCTS

2126

Tettweiler (P). **Snack foods worldwide.** *Food Technology* 45(2): 1991: 58-62

This article examines the types and market data for many of the snack foods, especially those identified as savoury products. Aspects covered include products and prospects, and world snack food markets (chip sizes and shapes, chip flavours, extruded snacks, flavours of extruded snacks, muesli and granola bars, sweet extruded snacks and other snack foods). BV

2127

Bocker (G), Vogel (RF) and Hammes (WP). ***Lactobacillus sanfrancisco* - a stable element in a sour dough starter culture.** *Getreide-Mehl und Brot* 44(9): 1990: 269-274 (De)

2128

Spicher (G), Rocken (W) and Brummer (J-M). **Determination of revitalization of the microflora in storable sour doughs.** *Getreide-Mehl und Brot* 44(9): 1990: 274-279 (De)

## Bread

2129

Bhupendar Singh, Bajal (M) and Sidhu (JS). **Spoilage of bread - causes and remedies.** *Indian Food Packer* 45(3): 1991: 66-76

Bread staling has aspects like crust staling and crumb staling. Staling of bread is influenced by protein level, carbohydrates type and amount, pentosans, quality of wheat flour, shortenings and salt and yeast level. Addition of egg, milk solids, modified starch, protein, enzymes and potato also influence staling. Moisture content of bread and storage temp. also influence staling. Antistaling agents could be added to control staling or the processing conditions could be varied to some extent



to control staling. Causes for ropiness and mold growth and means to check these have also been indicated. Future research that need to be done to control staling has been mentioned briefly. VKR

2130

Swyngedau (S), Nussinovitch (A), Roy (I), Peleg (M) and Huang (V). **Comparison of four models for the compressibility of breads and plastic foams.** *Journal of Food Science* 56(3): 1991; 756-759

The sigmoid compressive stress-strain relationship of rye bread, pumpernickel bread and 2 polyurethane foams (0 - 75% deformation) were fitted by 4 empirical models having 3 or 4 parameters. No unique model was inherently superior for goodness of fit or for strain definition, that is whether it was presented as an engineering or Hencky's strain. Two models, however, one with three and the other with four parameters, were easier to interpret in terms of stress-strain relationship shape characteristics and are recommended. AS

2131

Gasiorowski (H) and Abdalla (M). **Flad-bread in the world.** *Getreide-Mehl und Brot* 44(9): 1990; 281-283 (De)

## Pasta

2132

Mattern (GC), Winston (M) and Rosen (JD). **Determination of pirimiphos-methyl in pasta by gas chromatography/chemical ionization mass spectrometry.** *Journal of Food Safety* 11(1): 1990; 1-7

Pirimiphos-methyl residues were determined by capillary column GC using an ion trap mass spectrometer in the chem. ionization mode as the detector. The limit of detection was 0.005 p.p.m. Recoveries from spaghetti were 83.0% at the 0.100 p.p.m level and 93.3% at the 0.010 p.p.m level of 48 spaghetti samples analysed, 38 contained detectable residues between trace ( $> 0.005$  p.p.m) and 0.180 p.p.m. Electron ionization (EI) was used to confirm residues as low as 0.016 p.p.m in more concentrated extracts. KMA

## MILK AND DAIRY PRODUCTS

### Milk

2133

Byrne (RD), Bishop (JR) and McGilliard (ML). **Selective preliminary incubation for Gram-negative psychrotrophic bacteria in milk.** *Journal of Food Protection* 52(6): 1989; 396-398

Milk samples containing crystal violet, benzalkonium chloride, crystal violet: benzalkonium chloride, or alkylaryl sulfonate were inoculated with each of *Pseudomonas fluorescens*, *Pseudomonas fragi*, *Pseudomonas putida*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus cereus*, *Staphylococcus aureus*, and *Streptococcus* sp. Samples were incubated at 21 C for 18 h, and growth of the bacteria monitored to evaluate the inhibitory effect of the added reagents. Benzalkonium chloride proved to be the preferred inhibitor for selective incubation. It inhibited growth of *Bacillus cereus*, *Staphylococcus aureus*, and *Streptococcus* sp. at initial cell concn. of  $10^1$ ,  $10^2$  and  $10^4$ /ml, while allowing uninhibited growth of all *Pseudomonas* species tested with an av. increase of 3 logs. This finding is most important for the selective preliminary incubation necessary prior to milk quality assessment by plating and rapid instrumentation methods. AS

2134

Huhtanen (CN) and Jones (CO). **A procedure for the direct microscopic count of bacteria in non-fat dry milk.** *Journal of Food Protection* 52(6): 1989; 404-406, 411

Bacteria in non-fat dried milk (NDM) were enumerated by a method involving preliminary solubilization of the milk proteins in 0.015 N NaOH followed by centrifuging, washing in the NaOH, and microscopically examining stained smears. The method was used to enumerate bacteria in samples of NDM obtained from government surplus stocks or from local retail sources. Bacterial counts from surplus NDM ranged from  $4.64 \times 10^5$  to  $2.83 \times 10^6$ /g (the mean and median were, resp., 6.23 and  $2.84 \times 10^6$ /g). Counts from retail samples ranged from  $4.48 \times 10^5$  to  $2.42 \times 10^7$ /g (mean and median were 5.57 and  $2.85 \times 10^6$ /g). The predominant bacteria in some samples were paired streptococci; other samples contained rod-shaped bacteria, some with identifiable spores. Comparison of this method with the Levowitz-Weber method indicated that it produced fewer artifacts, was applicable to NDM samples containing a wider range of bacteria, and did not require the use of the potentially carcinogenic tetrachloroethane. AS

2135

Harding (F). **Milk adulteration-freezing point depression.** *Journal of the Society of Dairy Technology* 43(3): 1990; 61



Griffiths (MW) and Phillips (JD). **Incidence, source and some properties of psychrotrophic *Bacillus* spp. found in raw and pasteurized milk.** *Journal of the Society of Dairy Technology* 43(3); 1990: 62-66

Spores of psychrotropic *Bacillus* spp were isolated from 58% of farm tank milks and about 69% of pasteurized milks. Counts of *Bacillus* spp in about 10% of raw milk samples reached  $1 \times 10^6$  cfu/ml and above within 7 days at 6 C. Psychrotropic spore counts in pasteurized milks ranged from < 0.5 to 170 spores/l with an av. of about 17/l. There was little correlation between the total bacterial count of the raw milk and presence of psychrotropic *Bacillus* spores. There was some evidence that the bulk tank itself may be a source of contamination. The spores in pasteurized milk probably were not the result of post pasteurization contamination. The optimum germination temp. for psychrotropic *Bacillus* spores was lower than that for spores of mesophilic strains. About 50% of the psychrotropic *Bacillus* strains isolated from milk were capable of growth at 2 C. AS

2137

Wilson (AB) and Gilmour (A). **Numbers and types of psychrotrophic bacteria in pasteurized milk subjected to a preincubated plate count at 21 C.** *Journal of the Society of Dairy Technology* 43(3); 1990: 79-81

On two separate occasions pasteurized milk samples were taken from a creamery on the day before and the day after the down-day (when no milk is processed and the plant is cleaned). On each occasion, 3 lots of 8 samples were taken throughout the processing period. All samples were subjected to a preincubated count (incubation at 6 C for 5 days followed by a plate count (21 C/25 h)). The results showed that (a) within each lot of 8 there was a large sample to sample variation in bacterial numbers; (b) bacterial numbers tended to increase the later the samples were taken in the day; (c) samples taken before the down-day were more heavily contaminated than samples taken after the down-day; (d) nearly all the bacteria isolated were found to be Gram-negative rods, primarily *Pseudomonas* spp. AS

2138

Kanno (C), Shirahuji (K) and Hoshi (T). **Simple method for separate determination of three flavins in bovine milk by high performance liquid chromatography.** *Journal of Food Science* 56(3); 1991: 678-681

The separate detn. of flavin adenine dinucleotide (FAD), flavin mononucleotide (FMN) and riboflavin (RF) bound to milk proteins. In addition to the free

flavins has been reported in this paper. Pyrophosphatase which hydrolyses FAD, was found in bovine milk and inactivated by boiling for 5 min. Extraction of flavins and deproteinization were performed simultaneously by pronase digestion. Separation and detn. of the three major flavins were by HPLC. Digestion of the boiled sample by 1:50 the amount of pronase to the sample protein for 1 h at 45 C resulted in release of bound flavins, deproteinization and a clear cut separation of FAD, FMN and RF by HPLC in the C 18 column. The recovery of FAD, FMN and RF was 97 - 99% in whole milk, 95 - 100% in dialyzed milk, and 99 - 100% in milk fat globule membrane. The method is simple, rapid, sensitive and reproducible. Bovine milk contained 202 µg of total flavins/100 g milk, of which FAD was 13.8, FMN 4.3 and RF 81.9 mol% (n = 6). SRA

2139

Reykdal (O) and Lee (K). **Soluble, dialyzable and ionic calcium in raw and processed skim milk, whole milk and spinach.** *Journal of Food Science* 56(3); 1991: 864-866

The highly bioavailable Ca in milk and poorly bioavailable Ca in spinach were measured chemically with and without simulated digestion. Effects of thermal processing on available Ca were also measured. Study indicated that Ca content in spinach was 80.3 mg/100g. Raw skim milk, processed skim milk, raw whole milk and processed whole milk was 107, 121, 101 and 100 mg/100g, resp., by dialysis and 108, 127, 103 and 102 mg/100g, resp., by solubility measure. Available Ca was atleast 9 times higher in milk than in spinach. Ionic Ca in spinach increased significantly during digestion, soluble and ionic soluble Ca decreased significantly during digestion of whole milk. Ca solubility increased with increasing hydrogen ion concn. After digestion, final pH of supernatant for solubility measurements was lower for whole milk (6.68 - 6.90) than for skim milk and spinach (6.92 - 7.11) due to digestion products formed. The pH of non-digested spinach homogenate (6.20 - 6.47) was lower than for milks (6.76 - 6.94). However, pH differences alone did not account for differences in available Ca. SRA

2140

Tziboula (A) and Dalgleish (DG). **Interaction of phosvitin with casein micelles in milk.** *Food Hydrocolloids* 4(2); 1990: 149-159

The effect upon milk of the addition of the egg protein, phosvitin, at concn. in the range 0 - 10 mg/ml has been examined. Several changes were immediately apparent: the pH of the milk decreased in proportion to the amount of added phosvitin, the



casein micelles were progressively dissociated and the micellar calcium phosphate was solubilized. Dissociation of the casein micelles arose mainly from the breakdown of the micellar calcium phosphate by the binding of Ca to the phosphatidylserine, and not because of the decrease in pH, which is a potential cause of dissociation. Although the casein micelles were largely dissociated, some phosphatidylserine bound to the residual sedimentable material and became incorporated with the caseins. The addition of phosphatidylserine to milk appeared to have results broadly similar to other methods (pH, EDTA treatment, dialysis) of solubilizing components of casein micelles. AS

## Skim milk

2141

Harjinder Singh and Creamer (LK). **Changes in size and composition of protein aggregates on heating reconstituted concentrated skim milk at 120 C.** *Journal of Food Science* 56(3); 1991; 671-677

Heat treatment at 120 C on reconstituted concentrated skim milk, resulted in the size distribution of the casein micelles shifting more protein into the large micelle fraction. The fraction contained little k-casein and its comp. did not vary greatly with heat treatment. The medium micelle fraction, which contained most protein after 4 min heating, gradually decreased in  $\alpha_s$ - and  $\beta$ -casein, content with time. The small micelle fraction lost  $\alpha_s$ - and  $\beta$ -casein, while gaining k-casein throughout the heating period. With heated milks that had been made free of colloidal calcium phosphate (CCP) showed that a proportion of the calcium phosphate in milk became less soluble. It is concluded that when reconstituted concentrated milk when heated at sterilization temp., at least two types of reactions occur. The first being the dissociation of k-casein from the micelle as whey protein-k-casein complexes. One second reaction in the aggregation of k-casein-depleted micelles by  $\text{Ca}^{2+}$  or by the precipitation of calcium phosphate. Both these reactions are more important in concentrated than in normal skim milk. SRA

## Milk products

2142

Collins (JL), Ebah (CB), Mount (JR), Draughon (FA) and Demott (BJ). **Proximate, nutritional and microbiological analyses of milk-sweet potato mixtures fermented with yoghurt bacteria.** *Journal of Food Science* 56(3); 1991; 682-684

Milk, sweet potato (SP), sucrose and gelatin mixtures were fermented with yoghurt bacteria. SP comprised 14, 16 or 18% of the milk-SP mixture. As

SP increased, the following components decreased (dry wt. basis, except for moisture): moisture, 81.3 - 79.7%; fat, 8.5 - 4.9%; and calculated calories, 1,726 - 1,651 kJ/100g (412 - 396 Kcal/100g). Likewise, these components increased: N-free extract, 66.3 - 69.8% and vitamins C, 0.30 - 0.41 mg/100g and A, 971 - 1,252 retinol equivalents/100g. On av., the product contained 19% protein, 3.8% ash and 2.5% dietary fiber. The lactic acid bacteria count in the product after 6.5 h incubation was  $\log 8.2 (1.585 \times 10^6)$  CFU/g. AS

2143

Collins (JL), Ebah (CB), Mount (JR), Demott (BJ) and Draughon (FA). **Production and evaluation of milk-sweet potato mixtures fermented with yoghurt bacteria.** *Journal of Food Science* 56(3); 1991; 685-688

Investigations were made to establish conditions for making a fermented product with sweet potato (SP) as an ingredient, and to determine the effect of SP on colour, texture and sensory attributes of the product. SP puree of 12 - 18% was combined with milk, sucrose, gelatin and freeze-dried yoghurt to produce a fermented product. Incubation time to ferment the mixture to 0.85% titratable acidity (TA) were 0.75 - 1.75 h longer than for commercial yoghurt. Rates of TA development decreased as levels of SP and sugar were increased. Time of fermentation ranged from 6.25 - 7.25 h. Addition of SP contributed to increased firmness, yellow colour,  $\beta$ -carotene and flavour. A trained panel scored the samples a high level of acceptability for all factors. A consumer panel preferred the product with 16% SP. Panelists gave mean scores for sensory attributes from 6.3 - 7.0 (scale 1 to 8) which indicated such products should be attractive to consumers. SRA

## Cheese

2144

Burde (SD). **Cheddar cheese.** *Indian Dairyman* 43(8); 1991; 356-361

This article highlights the role of cheese makers in an industrial environment. Characteristics of the process and different stages involved in Cheddar cheese making are described. Addition of starter and rennet, cutting the curd, cooking, draining, cheddaring, milling, salting and pressing and ripening process are briefly described. SRA

2145

Babayan (VK) and Rosenau (JR). **Medium-chain triglyceride cheese.** *Food Technology* 45(2); 1991; 111-114



Advantages of consuming cheese containing medium-chain triglycerides for patients suffering from various malabsorption syndromes is discussed in this article. BV

#### **Aracena cheese**

2146

Garrido (MP), Inigo (B) and Barcenilla (JM). **Microbiological and physico-chemical study of Aracena cheese yeast microflora.** *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2): 1991: 4-6

The yeast microflora was studied in artisanal Aracena cheeses. A total of 145 strains and of 9 sp. were identified. Among the 9 sp. recorded, *Cryptococcus laurentii* (40.7%) predominated and asporogenous sp. (83.4%) were much more prevalent than ascosporous sp. (16.4%). AS

#### **Cheddar cheese**

2147

Trepanier (G), Simard (RE) and Lee (BH). **Effect of added lactobacilli on composition and texture of Cheddar cheese during accelerated maturation.** *Journal of Food Science* 56(3): 1991: 696-700

The influence of addition of live *Lactobacillus casei-casei* L2A and/or cell homogenates at different stages of cheese making on physico-chemical and rheological parameters of Cheddar cheese in relation to acceleration of ripening has been studied. Study revealed that addition of *L. casei-casei* L2A as live cells and cell homogenates resulted in good-quality Cheddar cheese with 40% increase in flavour intensity compared to control cheeses. The recommended treatment (Live lacto + lyo. ch + Ren) lowered the cheese pH, causing the cheese to fracture easily at the beginning of the ripening period. Rheological properties showed the same general pattern of evolution in experimental as in control cheeses. SRA

#### **Cheese-whey**

2148

Chen (J-P) and Wang (C-H). **Microfiltration affinity purification of lactoferrin and immunoglobulin G from cheese-whey.** *Journal of Food Science* 56(3): 1991: 701-706, 713

#### **Cottage cheese**

2149

Kaup (SM), Greger (JL) and Lee A. **Nutritional evaluation with an animal model of cottage cheese fortified with calcium and guar gum.** *Journal of Food Science* 56(3): 1991: 692-695

Apparent absorption of Ca by rats from cottage cheese was very efficient under the conditions tested. However, overall Ca retention and, to a lesser extent, bone Ca content increased with each increment in dietary Ca. Despite sensitivity of the model to variation in Ca intake, no effect of guar gum on Ca utilization was noted. Increasing the Ca added to cottage cheese increased P retention, did not antagonize utilization of Mg and Zn, and only slightly decreased Fe utilization in rats. AS

#### **Mozzarella cheese**

2150

Ravi Sundar (M) and Upadhyay (KG). **Influence of casein/fat ratio of milk on baking, rheological and sensory characteristics of buffalo milk Mozzarella cheese.** *Journal of Food Science and Technology (India)* 28(2): 1991: 98-100

The melting and fat leakage properties of Mozzarella cheeses were significantly influenced by casein/fat (C/F) ratios. The cheese made from low C/F ratio showed the highest melting and fat leakage. These characteristics declined progressively with increase in C/F ratio of milks. The rheological characteristics of cheeses were significantly influenced by C/F ratio of cheese milk. The cheese made using the lowest C/F ratio had the least hardness, cohesiveness, springiness, chewiness and gumminess than its counterpart made from higher C/F ratio. The value of each rheological character increased progressively with increase in C/F ratio of milk. Organoleptically, the cheese made from 0.7 C/F ratio milk had the highest total score, whereas least was observed for 0.9 C/F ratio cheese. The cheese from 0.5 C/F ratio was ranked significantly high for flavour, whereas 0.7 C/F ratio milk cheese had the best score (though non-significant) for body and texture; but flavour wise it was at par with the former. The cheeses were ranked based on C/F ratio in the order 0.7 greater than 0.6 greater than 0.8 greater than 0.5 greater than 0.9 for their suitability as toppings on pizza pie. AS

#### **Desserts**

2151

Keller (SE), Fellows (JW), Nash (TC) and Shazer (WH). **Formulation of aspartame-sweetened frozen dairy dessert without bulking agents.** *Food Technology* 45(2): 1991: 102-106



The development of a frozen dairy dessert using lactase which allows the complete replacement of sugar with a high-potency sweetener and without the addition of bulking agents is described in this article. BV

#### Ice cream

2152

Carter (HD), Cavanagh (CF), Higgins (JL) and Wilbey (RA). **Assessment of the heat treatment of ice cream mixes by enzyme assay.** *Journal of the Society of Dairy Technology* 43(3); 1990; 67-68

Ice cream mixes containing varying levels of sweeteners were subjected to heat treatment at 65.6 C for upto 30 min. The levels of  $\gamma$ -glutamyl transpeptidase (GGTP) and the survival of streptococci were monitored. The reduction in GGTP activity was less than had been expected from earlier work. Neither GGTP activity nor survival of streptococci could be related statistically to water activity under the experimental conditions. AS

2153

O'Kane (G) and Wilbey (RA). **The influence of protein levels on the quality of sheep's milk ice cream.** *Journal of the Society of Dairy Technology* 43(3); 1990; 77-78

Sheep's milk ice creams with a range of protein and fat contents were produced on a pilot scale and subjected to preference testing. Preference scores correlated well with protein content over the range 4.4 - 5.9%. In one series of samples there appeared to be a correlation between fat content and preference, but overall the relationship was not significant. AS

#### Wheys

2154

Singh (RK), Shah (BB), Nielsen (SS) and Chambers (JV).  **$\alpha$ -lactose monohydrate from ultrafiltered whey permeate in one-step crystallization using ethanol-water mixture.** *Journal of Food Science* 56(3); 1991; 777-781, 788

A one-step crystallization process was developed for production of edible grade  $\alpha$ -lactose monohydrate from ultrafiltered sweet cheese whey permeate at room temp. Concn. of permeate to 30% total solids followed by clarification lowered the ash of the permeate. Constant agitation during crystallization with 80% ethanol (v/v) at pH 2.5 yielded almost 88% lactose in 3 h. Alcoholic acid addition (1%) at the end of crystallization time and agitation for 10 min was optimum to reduce entrapped impurities in the

form of ash and protein. Lactose quality factors were comparable to commercial edible grade lactose. United States Pharmacopeia grade lactose was also produced using the ethanol-water mixtures. AS

2155

Rector (D), Matsudomi (N) and Kinsella (JE). **Changes in gelling behaviour of whey protein isolate and  $\beta$ -lactoglobulin during storage: Possible mechanism(s).** *Journal of Food Science* 56(3); 1991; 782-788

Dry-heat treatment of a dialyzed whey protein isolate at 80 C for 7 days resulted in a decrease in hardness (from 1.55N to 0.49N) of gels formed from a 12% solution. Partial denaturation and progressive polymerization of protein was observed. The monomeric  $\beta$ -lactoglobulin concn. of the whey decreased from 60.64% to 33.33% after 7 days at 80 C. The rate constants determined at 40 to 80 C were used to calculate an Arrhenius relationship for the polymerization. After one yr at 25 C, 18% of monomeric  $\beta$ -lactoglobulin was projected to be converted to higher mol.-wt. material. The polymerization apparently did not involve disulphide cross-links. AS

2156

Kuhn (PR) and Foegeding (EA). **Factors influencing whey protein gel rheology: Dialysis and calcium chelation.** *Journal of Food Science* 56(3); 1991; 789-791

Influence of dialyzable compounds on the rheological properties (shear stress and shear strain at failure) of heat-induced whey protein conc. (WPC) and whey protein isolate (WPI) gels was examined. Dialyzing WPC and WPI suspensions prior to gelation increased the stress of two of three WPC gels and a WPI gel. Dialysis also significantly increased the strain of the same two WPC gels, normalizing all strain values. Replacement of Ca lost through dialysis did not significantly change gel rheology. However, chelating Ca caused a significant decrease in the stress of all gels; a min. amount of Ca and/or a Ca complex appears to have a major role in whey protein gelation. AS

#### Yoghurts

2157

Fellows (JW), Chang (SW) and Shazer (WH). **Stability of aspartame in fruit preparations used in yoghurt.** *Journal of Food Science* 56(3); 1991; 689-691

The shelf-life of fruit preparations made with aspartame for use with yoghurt was studied.



Microbiological quality, pH, colour, aspartame degradation (in fruit preparation) and sensory acceptance (when mixed into yoghurt) were also determined. Investigations indicate that percent aspartame recovery was influenced by pH, time and temp. Although good stability of aspartame in fruit preparations at high temp. is indicated, good manufacturing practice includes continued storage of such fruit preparations at 4.4 C or below. A colour change was observed in fruit preparations at room temp. (above 21.1 C). Test showed that shelf-life estimates for the fruit preparations were 1 1/2 months at 32.2 C, 4-6 months at 21.1 C, and 6 months at 4.4 C. SRA

## MEAT AND POULTRY

2158

Morita (J-I) and Ogata (T). **Role of light chains in heat-induced gelation of skeletal muscle myosin.** *Journal of Food Science* 56(3): 1991: 855-856

### Meat

2159

Palombo (R) and Wijngaards (G). **Characterization of changes in psychometric colour attributes of comminuted porcine lean meat during processing.** *Meat Science* 28(1): 1990: 61-76

2160

Papadopoulos (LS), Miller (RK), Ringer (LJ) and Cross (HR). **Sodium lactate effect on sensory characteristics, cooked meat colour and chemical composition.** *Journal of Food Science* 56(3): 1991: 621-626, 635

2161

Miller (MF), George (SM), Azain (MJ) and Reagan (JO). **Calcium and time postmortem effects on functional and textural characteristics of porcine semimembranosus muscle.** *Journal of Food Science* 56(3): 1991: 632-635

2162

Savage (AWJ), Warriss (PD) and Jolley (PD). **The amount and composition of the proteins in drip from stored pig meat.** *Meat Science* 27(4): 1990: 289-303

### Beef

2163

Shelf (LA). **Survival of *Listeria monocytogenes* in ground beef or liver during storage at 4 and 25 C.** *Journal of Food Protection* 52(6): 1989: 379-383

Survival and growth of 3 *Listeria monocytogenes* strains (Scott A, Eric 1, and ATCC 55122) were studied in ground beef or liver during storage from freshness to spoilage at 4 and 25 C. Cells were enumerated on Plate Count Agar, Tryptase Soy Agar, and selective media, including McBride Listeria Agar (MLA), Cyclohexanedione Maltolac Acid Phenylethanol Agar (CNPA), LiCl Phenylethanol Moxalactam Agar (LPM), and LPM with potassium tellurite (LPMT). Aerobic natural microflora in the fresh uninoculated samples ranged from  $10^4$  to  $10^5$  CFU/g, and *L. monocytogenes* inocula were ca.  $10^3$  or  $10^5$  CFU/g. Total aerobes after 2 wk at 4 C were  $> 10^6$  or  $10^7$ /g in meat or liver resp., while recovered numbers of *L. monocytogenes* remained unchanged during a storage of over 30 days in either ground meat or liver. Samples stored at 25 C confirmed recovery but absence of multiplication of the organism. LPM or LPMT provided the best selective environment for direct plating of meat. Despite differences in comp. and spoilage pattern of meat and liver, no difference was observed in the fate of *L. monocytogenes* in these foods. AS

2164

Kalchayanand (N), Ray (B), Field (RA) and Johnson (MC). **Spoilage of vacuum-packaged refrigerated beef by *Clostridium*.** *Journal of Food Protection* 52(6): 1989: 424-426

A motile, Gram-positive, spore-forming, anaerobic, psychrotrophic bacterial sp., probably from the genus *Clostridium*, was involved in spoilage of vacuum-packaged refrigerated fresh beef. The spoilage was associated with accumulation of large quantities of foul smelling gas and purge in the bag and loss of colour and texture of the meat. Attempts to grow the organism in several lab. media were not yet successful; however, inoculation of purge from a spoiled sample into a fresh beef, vacuum-packaging and refrigeration storage facilitated growth of this sp. and produced characteristic spoilage of beef. AS

2165

Krishnan (KR) and Sharma (N). **Studies on emulsion-type buffalo meat sausages incorporating skeletal and offal meat with different levels of pork fat.** *Meat Science* 28(1): 1990: 51-60

Ready-to-eat emulsion-type buffalo meat sausages were developed by using a combination of 80% meat components with 20% pork back fat. The meat components were constituted of 70 parts buffalo skeletal meat and 30 parts offal meat (rumen meat and heart meat in equal proportions). The emulsion stability, cooking losses of emulsions and sausages, comp. of cooked sausages, eating quality of



sausages and the microscopic characteristics of the raw emulsion and cooked sausages were studied. The light microscope micrograph of the raw emulsion showed uniformly well distributed fat globules embedded in a dense protein gel. The cooked emulsion also showed uniformly sized fat globules well distributed in a fine, compact, coagulated protein gel, which retained their original spherical shape. Good quality emulsion-type sausages could be produced having a high emulsion stability (0.87 plus or minus 0.07 ml fat release / 100g emulsion); a low emulsion cooking loss (9.60 plus or minus 0.60%) and a low sausage cooking loss (8.83 plus or minus 0.48%). The overall acceptability of sausages was also high. AS

2166

Srinivas (S), Reddy (PM) and Reddy (KS). **Detection of mutton, beef and buffalo beef with antisera to species liver by double gel immuno-diffusion, immuno-electrophoresis and counter immuno-electrophoresis.** *Journal of Food Science and Technology (India)* 28(2): 1991: 123-125

Antisera were raised in rabbits against fresh (native) liver antigens of sheep, cattle and buffalo. Experiments were conducted to identify meats of sheep (mutton), cattle (beef), and buffalo (buffalo beef) using double gel immuno-diffusion (DID), immuno-electrophoresis (IE) and counter immuno-electrophoresis (CIE) techniques. All the antisera raised showed cross reactions amongst meats of sheep, goat, cattle and buffalo. However, the antisera revealed the presence of one distinct, separate precipitation line of each of sheep, cattle and buffalo sp. meats tested. When tried to prove the separate line as sp. - specific antigenic fraction, the sera could not be made sp. - specific. AS

2167

Stoick (SM), Gray (JI), Booren (AM) and Buckley (DJ). **Oxidative stability of restructured beef steaks processed with oleoresin rosemary, tertiary butylhydroquinone, and sodium tripolyphosphate.** *Journal of Food Science* 56(3): 1991: 597-600

2168

Parrish (FCJr), Boles (JA), Rust (RE) and Olson (DG). **Dry and wet aging effects on palatability attributes of beef loin and rib steaks from three quality grades.** *Journal of Food Science* 56(3): 1991: 601-603

2169

Muller (TS), Johnson (RC), Costello (WJ), Romans (JR) and Jones (KW). **Storage of structured beef steakettes produced with algin/calcium/adipic**

**acid gel.** *Journal of Food Science* 56(3): 1991: 604-606

2170

Fritz (JD) and Greaser (ML). **Changes in titin and nebulin in postmortem bovine muscle revealed by gel electrophoresis, Western blotting and immunofluorescence microscopy.** *Journal of Food Science* 56(3): 1991: 607-610, 615

2171

Mitsumoto (M), Cassens (RG), Schaefer (DM) and Scheller (KK). **Pigment stability improvement in beef steak by ascorbic acid application.** *Journal of Food Science* 56(3): 1991: 857-858

2172

Liu (MN), Huffman (DL) and Egbert (WR). **Replacement of beef fat with partially hydrogenated plant oil in lean ground beef patties.** *Journal of Food Science* 56(3): 1991: 861-862

2173

Campos (C), Gerschenson (LN), Alzamora (SM) and Chirife (J). **Determination of sorbic acid in raw beef: An improved procedure.** *Journal of Food Science* 56(3): 1991: 863, 866

## Mutton

2174

Mahajan (P) and Panda (PC). **Effect of post-exsanguination electrical stimulation on meat quality and palatability attributes of mutton.** *Indian Food Packer* 45(3): 1991: 9-14

Primal cuts (foreshank, shoulder and leg) prepared out of left side of the carcass of adult male sheep were stimulated with low voltage electric current (100 V, 5 A, 50 cycles/s) for 1, 1 1/2 and 2 min when the right side of the carcass served as control. Colour, firmness, and muscle texture were better in electrically stimulated carcasses than the control. Electrical stimulation also improved the tenderness, juiciness and overall acceptability compared to the control. VKR

## Sheep

## Lamb

2175

Moore (VJ). **Thawing of lamb lion chops in air and CO<sub>2</sub>. Effect on colour and drip.** *Meat Science* 28(1): 1990: 9-20



Colour retention and drip loss was assessed during retail display for chilled lamb chops displayed fresh or stored in CO<sub>2</sub> for 7 wks before display, and for chops frozen for various times and thawed in air or CO<sub>2</sub>. A sensory panel found fresh lamb chops to have an acceptable display life of 1 day, while chops which had been frozen for 1 day and then thawed lasted 2 days. Holding chops for 7 wks in a CO<sub>2</sub> atm. at -1.5 C improved display life to 3 days, but frozen chops held for 7 wks before thawing had deteriorated in colour, and only one group was acceptable on the initial day of display. Initially there were no differences in Hunter L values (brightness) due to treatment, but chilled chops or those frozen for 1 day showed a greater increase in L values by the second day than those frozen for 7 wks, after which there was no change in brightness. Hunter a values (redness) were higher in chilled chops and those thawed after 1 day frozen storage than those frozen for 7 wks before thawing. Hunter b values (yellowness) were greater at all times in chilled chops held for 7 wks and varied amongst the other treatments. The measured % drip from chops frozen for only 1 day was greater on thawing than drip from chops frozen for 7 wks before thawing. Drip during display, assessed by a sensory panel, increased more in those chops stored either chilled or frozen for 7 wks before display. AS

2176

Sheridan (JJ). **The ultra-rapid chilling of lamb carcasses.** *Meat Science* 28(1): 1990: 31-50

Experiments were carried out on the effects of chilling lamb carcasses very rapidly in a pre-rigor condition. The chilling regime which was finally used was to cool the carcasses at an ambient temp. of -20 C and an air speed of 1.5m/s for 3.5 h. Examination of striploins from carcasses subjected to this chilling regime showed that, after 7 days storage, the meat was as tender as that from carcasses which had been conventionally chilled at 4 C for 24 h. There were significant reductions in wt. loss as a result of ultra rapid chilling, compared to conventionally chilled carcasses. The reductions obtained after 24 h varied between 0.8 and 0.9%, depending on whether the carcasses were washed or unwashed. AS

## Pork

2177

Brewer (MS) and Harbers (CAZ). **Effect of packaging on physical and sensory characteristics of ground pork in long-term frozen storage.** *Journal of Food Science* 56(3): 1991: 627-631

2178

Halloran (JD), Rogers (RW), Mader (WB) and Allen (TG). **Processing characteristics of pork as influenced by porcine somatotropin (pST) administration to growing finishing swine.** *Journal of Food Science* 56(3): 1991: 558-563 561

2179

Jeremiah (LE), Murray (AC) and Gibson (LL). **The effects of differences in inherent muscle quality and frozen storage on the flavour and texture profiles of pork loin roasts.** *Meat Science* 27(4): 1990: 305-327

## Products

### Meat

2180

Whiteley (AM) and D'Souza (MD). **A yellow discoloration of cooked cured meat products - Isolation and characterization of the causative organism.** *Journal of Food Protection* 52(6): 1989: 392-395

An organism has been isolated in pure culture that is capable of causing a yellow discoloration on a cooked cured meat substrate under aerobic and anaerobic conditions. This organism has subsequently been identified as a member of the genus *Streptococcus*. The characteristics were such that a tentative identification as *Streptococcus faecium*, sub-sp. *Casseliflavus* was made. The organism is extremely heat resistant and could survive a heat processing of 71.1 C for 20 min. The yellow discoloration on a vacuum packaged luncheon style meat takes 3 to 4 wk to become apparent under refrigerated storage. The pigment was extracted and separated by TLC. The evidence points to the compound being carotenoid in nature. AS

2181

Noel (P), Briand (E) and Dumont (JP). **Role of nitrite in flavour development in uncooked cured meat products. Sensory assessment.** *Meat Science* 28(1): 1990: 1-8

Fermented dry sausages were evaluated by a trained taste panel. Flavour of the samples made from mixes with added nitrite was found significantly different from that of the nitrite-free samples. Basically, nitrosated samples were allotted a stronger and a more typical flavour. BV



## Bologna

2182

Claus (JR) and Hunt (MC). **Low-fat, high added-water bologna formulated with texture-modifying ingredients.** *Journal of Food Science* 56(3); 1991: 643-647, 652

## Ham

2183

Andersen (HJ), Bertelsen (G), Ohlen (A) and Skibsted (LH). **Modified packaging as protection against photodegradation of the colour of pasteurized, sliced ham.** *Meat Science* 28(1); 1990: 77-83

2184

Eadie (LM), Jones (PN) and Harris (PV). **Texture of ham.** *CSIRO Food Research Quarterly* 50(3); 1990: 72-81

## Sausages

2185

Beilken (SL), Eadie (LM), Jones (PN) and Harris (PV). **Objective and subjective assessment of Australian sausages.** *Journal of Food Science* 56(3); 1991: 636-642

## Poultry

2186

Cox (NA), Bailey (JS), Corral (DF) and Shotts (EB). **Comparison of enrichment and plating media for isolation of *Yersinia*.** *Poultry Science* 69(4); 1990: 686-693

*Yersinia enterocolitica* (Serotypes 0:3 or 0:8), *Y. frederiksenii*, *Y. kristensenii*, or *Y. intermedia* along with  $10^8$  cells of each of 3 extraneous organisms (*Escherichia coli*, *Enterobacter aerogenes pseudomonas fragi*), all commonly found on market poultry, were inoculated into 5 enrichment media followed by streaking onto 11 plating media to determine the most-efficacious combinations for future surveys or assessment studies. For *Y. enterocolitica* (0:8), infrequent recoveries were made using yeast extract-rosebengal-bile oxalate sorbose broth and phosphate-buffered saline (4 C) followed by plating onto pectin, DNase-Tween 80 (polyoxyethylene sorbitan monooleate)-sorbitol, MacConkey-Tween 80, or cefsulodin-irgasan-novobiocin (CIN) agars. With *Y. enterocolitica* (0:3), recoveries were most frequently made using phosphate-buffered saline, sorbitol bile (incubated for 17 days) and yeast extract-rosebengal-bile oxalate sorbose broth

followed by plating onto pectin, CIN, bismuth sulphite (Difco Lab. Detroit, MI), or modified Rimler-Shotts agar. For *Y. frederiksenii*, *Y. kristensenii*, and *Y. intermedia*, incubation in sorbitol bile for 17 days or in yeast extract-rosebengal-bile oxalate sorbose broth, followed by plating onto CIN, pectin, DNase-Tween 80-sorbitol, cellobiose-arginine-lysine agar, or MacConkey-Tween 80 agar yielded the most-frequent recoveries. Overall, the CIN and pectin agars performed best for the recovery of the *Yersinia* bacterium; the modified selenite broth and the bismuth sulphite plating agars were unsatisfactory in the present study. AS

2187

Acton (JC), Kropp (PS) and Dick (RL). **Properties of ovalbumin, conalbumin, and lysozyme at an oil-water interface and in an emulsion system.** *Poultry Science* 69(4); 1990: 694-701

The interfacial adsorption properties of lysozyme, conalbumin, and ovalbumin at pH 6.5 were measured, using linear regression analyses of the interfacial responses with respect to protein concn. After preparation of the oil-in-water emulsions, analyses were conducted to determine emulsion stabilities, mean dispersed globule diameters, and the concn. of irreversibly adsorbed protein per unit area of the dispersed phase. Lysozyme showed less total interfacial surface adsorption ( $1.94 \text{ mg/m}^2$ ) than conalbumin ( $7.28 \text{ mg/m}^2$ ) or ovalbumin ( $9.37 \text{ mg/m}^2$ ) when the interface was at saturation. However, both conalbumin and ovalbumin had less irreversibly adsorbed protein in the interfacial films of the emulsions ( $0.74 \text{ mg/m}^2$  and  $0.11 \text{ mg/m}^2$ , resp.) compared to lysozyme ( $1.15 \text{ mg/m}^2$ ). A lower emulsion stability was provided by lysozyme than by the other proteins. The lower stability provided by lysozyme was related to its adsorption characteristics and the higher mean diameter of dispersed globules ( $34 \mu$ ) within the emulsion, compared with the respective data for conalbumin and ovalbumin. Overall, the results obtained supported the concept that lysozyme possesses more surface hydrophobicity and less molecular flexibility for conformational alteration at the oil-water interface than conalbumin or ovalbumin. AS

## Chickens

2188

Sams (AR). **Lathrogen effects on the collagen heat stability and tenderness of spent fowl muscle.** *Poultry Science* 69(3); 1990: 477-481



Spent laying hens were fed a diet containing 0.18% (75 mg/kg of body wt./day) of  $\beta$ -aminopropionitrile (BAPN) for 0, 42 or 64 days to inhibit crosslinking in newly formed collagen molecules without hindering collagen degradation. This was done in an attempt to reduce the proportion of heat-stable collagen molecules in the muscle tissue in order to improve the tenderness of the cooked meat from spent fowl. 64 days of dietary exposure to BAPN significantly increased the proportion of total collagen that was heat-labile, but also increased the total collagen concn. of the *Biceps femoris* muscle. The 42-day treatment did not alter the proportion for heat-stable collagen and labile collagen but did result in an increase in the total concn. of collagen. Despite the changes in the proportion of heat-stable collagen, no improvement in the shear value for cooked meat was observed, presumably due to a slower degradation rate than expected or to an increase in total collagen. AS

2189

Harrison (MA) and Carpenter (SL). **Survival of large populations of *Listeria monocytogenes* on chicken breasts processed using moist heat.** *Journal of Food Protection* 52(6): 1989: 376-378

The ability of *Listeria monocytogenes* to survive and proliferate on chicken processed using a moist heating method was investigated. Chicken breasts were inoculated with  $10^6$  -  $10^7$  microorganisms/g, cooked to one of five different cooking temp., then either vacuum packaged or wrapped in an oxygen permeable film and stored at 4 C for upto 4 wk or at 10 C for upto 10 days. Lethality was directly related to the cooking temp. employed in this study, however survivors were encountered at each of the heat treatments employed. By the 4th wk of storage at 4 C, the *L. monocytogenes* population in all of the samples, except those cooked to 82.2 C increased significantly. In contrast, within the first wk of storage at 4 C the population increased in only 3 samples (73.9 C film overwrap, 65.6 C and 71.1 C vacuum packaged). Storage at 10 C allowed microbial populations in 6 of the 10 treatments to significantly increase within 3 days, with the remaining 4 significantly increasing within 10 days. Differences in packaging influenced the growth rate of *L. monocytogenes* at both storage temp. AS

2190

Stern (NJ) and Meinersmann (RJ). **Potentials for colonization control of *Campylobacter jejuni* in the chicken.** *Journal of Food Protection* 52(6): 1989: 427-430, 435

*Campylobacter jejuni* is a major cause of enteritis in humans. Chicken is the most important vehicle in transmitting the agent to humans in the United

States. The organism colonizes the intestinal tract of the chicken and there enters into a non-pathologic, commensal relation. During slaughter and processing the organism can, and does, adulterate the product. Unsuccessful attempts have been made to "clean" the contaminated carcasses or provide pathogen free flocks and rearing facilities. Therefore the approach to intervene and diminish *C. jejuni* in the intestinal tract is now being studied. We have been gathering background data on colonization dose, isolate differences regarding colonization, competitive exclusion, expression of outer membrane proteins by the organism, immune response of the chicken to colonization, antibody neutralization of colonization, and how poultry lineage influences susceptibility to colonization. By using this information we hope to diminish colonization of poultry with *C. jejuni*. AS

2191

Barbeau (WE) and Schnepf (M). **Sensory attributes and thiamine content of roasting chickens cooked in a microwave, convection microwave and conventional electric oven.** *Journal of Food Quality* 12(3):1989: 203-213

Fresh whole roasting chickens were cooked to an internal temp. of 79 C in either a microwave, convection microwave or conventional electric oven. The sensory attributes of breast meat samples from chickens cooked in the 3 ovens were evaluated by untrained and lab. panels. Untrained panelists found convection microwave cooked samples to be more acceptable in terms of juiciness than microwave cooked samples. Lab. panelists rated the chicken cooked in the conventional oven as significantly more tender and juicy but similar in flavour intensity to chicken cooked in microwave ovens. Thiamine retention on a dry wt. basis ranged from 77% in conventionally cooked chicken breasts to 98% in microwave cooked chicken legs. AS

2192

Farkas (BE) and Singh (RP). **Physical properties of air-dried and freeze-dried chicken white meat.** *Journal of Food Science* 56(3): 1991: 611-615

The physical properties of diced, chicken white meat dried by 6 variations of air- and freeze-drying has been determined. Results indicate that freezing rate affected both surface area and pore size distribution of freeze-dried poultry meat while it had little effect on total porosity. A pre-freezing treatment of the air-dried material resulted in shorter drying times, with increase in porosity, surface area, and rehydration. The fraction of microporosity is significantly related to the ability of dried sample to rehydrate. The colour of freeze-dried product was



directly affected by freezing conditions while the pre-treatment or conditions during drying had little effect on colour of air-dried samples. The ability of a material to rehydrate is linked primarily to its porosity as well as chem. changes incurred during drying. SRA

2193

Lai (S-M), Gray (JI), Smith (DM), Booren (AM), Crackel (RL), Buckley (DJ). **Effects of oleoresin rosemary, tertiary butylhydroquinone, and sodium tripolyphosphate on the development of oxidative rancidity in restructured chicken nuggets.** *Journal of Food Science* 56(3): 1991: 616-620

Thiobarbituric acid reactive substances (TBARS) values and sensory scores demonstrated that sodium tripolyphosphate (STPP)/oleoresin rosemary (OR) was comparable to STPP/TBHQ in protecting the refrigerated and frozen chicken nuggets. In both studies combination of OR/STPP was found more effective than STPP or OR alone. STPP/OR and STPP/TBHQ also effectively retarded oxidative degradation of polyunsaturated fatty acids in chicken nuggets during frozen storage. No apparent beneficial effects on oxidative stability of the chicken nuggets were observed by adding OR to the frying oil. SRA

#### Broilers

2194

Bailey (JS), Fletcher (DL) and Cox (NA). **Listeria monocytogenes colonization of broiler chickens.** *Poultry Science* 69(3): 1990: 457-461

In three trials, a total of 108 broiler chickens were unchallenged or challenged orally with either  $10^2$  or  $10^6$  cells of *Listeria monocytogenes* at 1, 14, or 35 days of age. The birds were kept in separate wire-floored brooders and grow out batteries, fed unmedicated broiler-starter rations *ad libitum*, and killed 7 days postchallenge. The ceca, duodenum, spleen, liver (including gall bladder), and a cloacal swab were sampled from each bird and were analyzed for the presence of *L. monocytogenes*. In Trial 1, *L. monocytogenes* was recovered on all sampling days, but most frequently from birds challenged when 1 day old. In Trials 2 and 3, recovery was only from birds challenged at 1 day of age. The *L. monocytogenes* was not recovered from any uninoculated control birds. There was a dose-related colonization response ( $10^6 > 10^2$ ); and more recoveries were obtained from the ceca, spleen, and cloacal swabs than from the duodenum and liver. AS

2195

Cox (NA), Corral (FD), Bailey (JS), Shotts (EB) and Papa (CM). **The presence of *Yersinia enterocolitica* and other *Yersinia* species on the carcasses of market broilers.** *Poultry Science* 69(3): 1990: 482-485

Sixty ready-to-cook broiler carcasses obtained from several local supermarkets were tested for the presence of *Yersinia enterocolitica* and other *Yersinia* species. In the present study, the authors used two enrichment broths, yeast-extract/rosebengal oxalate sorbose (YER-BOS) and phosphate-buffered saline with a postenrichment KOH treatment (PBS-KOH), and two plating media, cefsulodin-irgasan-novobiocin (CIN) and pectin agar. *Yersinia* organisms were found on 34 of 60 carcasses (56.7%) and *Y. enterocolitica*, on 16 of 60 carcasses (26.7%). There was no significant difference between CIN and pectin agar, however, PBS-KOH yielded a significantly higher (P less than or equal to 0.05) detection rate than YER-BOS, regardless of the plating media used. None of the *Y. enterocolitica* isolates were found to be presumptively virulent. AS

2196

Moran (ETJr) and Bilgili (SF). **Processing losses, carcass quality, and meat yields of broiler chickens receiving diets marginally deficient to adequate in lysine prior to marketing.** *Poultry Science* 69(4): 1990: 702-710

#### Chicken patties

2197

Anand (SK), Pandey (NK), Mahapatra (CM) and Verma (SS). **Microbial quality and shelf-life of chicken patties stored at -18 C.** *Indian Journal of Poultry Science* 26(2): 1991: 105-108

The chicken patties contained food pathogens like staphylococci, coliforms and KF-streptococci in addition to aerobic mesophiles. The line test conducted during various steps of preparation indicated significant increase in all microbes during emulsion making stage, except staphylococci and psychrotrophs which increased slightly. The fresh frozen patties had lower counts of all the bacteria except yeast and moulds. Deep-fat frying of patties reduced microbial contaminants. During frozen storage at -18 C patties had shelf-life of 150 days and aerobic counts were within the acceptable limits. After 150 days of frozen storage, slight off-odour developed in the patties due to oxidative rancidity. Thiobarbituric acid increased from 0.28 to 2.17 mg malonaldehyde/Kg during storage with a decrease in pH value. SRA



## Quails

2198

Prabhakara Reddy (K) and Alfred Jayaprasad (I). **Influence of sodium tripolyphosphate treatment (STPP) on the physical characteristics of Japanese quail meat.** *Indian Journal of Poultry Science* 26(2): 1991: 98-104

Dual purpose 'Nandanam' strain of spent Japanese quails (480) of 25 wk old with males and females in equal number were slaughtered, dressed and chilled in slush ice solution containing 0, 3 and 6% food grade STPP for 3 or 6 h, drained and the moisture uptake determined. After vacuum-packing in polythene bags they were stored at refrigeration at 4 plus or minus 1 C for 72 h and 144 h and frozen stored at -18 plus or minus 1 C for 30 to 60 days. Evaluation was done for shear force value, thawing loss, and drip vol. and cooking losses. STPP at 3 and 6% significantly increased the moisture uptake and decreased the shear force value, thawing loss, drip vol., and cooking loss. Chilling for 6 h increased the moisture content and reduced the shear force value and cooking loss. Increase in storage period decreased the shear force value and cooking loss, and increased thawing loss and drip vol. Breast meat recorded higher shear force value. Sex had no significant influence on the cooking loss of spent Japanese quail. SRA

## Turkeys

2199

King (AJ), Dobbs (J) and Earl (LA). **Effect of selected sodium and potassium salts on the quality of cooked, dark-meat turkey patties.** *Poultry Science* 69(3): 1990: 471-476

Patties made with ground, dark turkey meat and various combinations of salts and water were cooked from various states: fresh; frozen then thawed; and frozen. The patties were evaluated for several quality characteristics. The formulation affected drip loss (for the uncooked, frozen and thawed patties), non-evaporative cooking loss, yield and fat. The storage condition affected yield and expressible moisture. There was a storage-condition-by-formulation interaction in terms of the non-evaporative cooking loss. The fresh, cooked formulations with water and alkaline tripolyphosphates were rated similarly, and lower, than 7 others. The frozen-and-cooked formulations containing only polyphosphates or water were rated lower than 5 others. AS

2200

King (AJ) and Fitzpatrick (DP). **Yield and proximate analysis of meat from turkeys fed to source of**

**supplemental fat.** *Journal of Food Quality* 12(3): 1989: 215-225

Yield of meat, skin and waste from selected parts of turkeys (12-22 wks) fed supplemental soybean oil and blended fat was determined. Meat was analyzed for protein, moisture, and fat. Males fed blended fat had increased breast yield of 21.4%, compared to 20.4% for those fed soybean oil. Turkeys fed blended fat has statistically greater protein and fat content (20.2 and 5.9% resp.) in drum/thigh meat than those fed soybean oil. Soybean oil produced significantly more wing meat (5.4%), compared to 5.2% for blended fat. Turkeys fed soybean oil also had more moisture in drum/thigh meat (73.2%), compared to 72.8% for blended fat. AS

## Products

### Eggs

2201

Sapkota (D) and Siddiqui (SM). **Effect of storage condition and duration on the quality of hard cooked eggs.** *Indian Journal of Poultry Science* 26(2): 1991: 109-113

Eggs aged for 48 h at 20 C were hard cooked, and stored at 20 C (ambient temp.), 60% RH and at refrigeration (5 C, 65% RH). Wt. loss, shell thickness and peeling during 3, 6, 9, 12 and 15 days storage were studied. Under both storage conditions the wt. loss was significantly ( $P < 0.01$ ) influenced by the duration of storage. The peeling quality was better when stored in ambient condition. Yolk centre and yolk surface colour did not alter at 20 C. Yolk pH was alkaline during storage. The sensory quality of hard cooked egg remained good for 6 days at 20 C but later progressive decline occurred. Under refrigeration, eating quality remained good for 15 days. At 20 C the surface microbial count of peeled eggs were within permissible limits upto 6 days storage and increased with further storage. Under refrigeration the microbial count did not increase appreciably even after 12 days storage. SRA

2202

Durance (TD). **Residual avidin activity in cooked egg white assayed with improved sensitivity.** *Journal of Food Science* 56(3): 1991: 707-709, 729

A study was made to increase the sensitivity of the dye 2-(4'-hydroxyazobenzene) assay (HABA) for avidin, combine the assay with an extraction method and validate the improved assay for detn. of residual avidin in cooked egg white products. Selected



products were then examined for avidin activity. The method was validated for linearity of response to increasing avidin concn., precision, accuracy, recovery and sensitivity. Mean residual avidin activity in fried, poached and boiled egg white was 33, 71 and 40% of the activity in raw egg white. SRA

2203

Dill (CW), Brough (J), Alford (ES), Gardner (FA), Edwards (RL), Richter (RL), Diehl (KC). **Rheological properties of heat-induced gels from egg albumen subjected to freeze-thaw.** *Journal of Food Science* 56(3); 1991: 764-768

A back-extrusion device was used to measure gel strength, elasticity, and viscosity index of heat-induced gels of albumen maintained at 80 C from 5 to 30 min. These rheological properties were the same in albumen refrigerated 24 h at 3 C as those observed in gels from fresh albumen suspensions. Short term frozen storage (-10 C for 24 h) significantly reduced each gel parameter compared with fresh (control) albumen gels. Incorporation of sucrose into fresh albumen protected rheological properties of the heat-induced gels from deleterious effects of freezing the albumen suspensions. Additions of 5 or 10% NaCl to albumen reduced or eliminated the ability of albumen to form heat-induced gels. AS

#### Egg powders

2204

Satyanarayana Rao (TS). **Changes in phospholipid browning of hens' whole egg powder packed in different packing materials.** *Journal of Food Science and Technology (India)* 28(2); 1991: 120-122

Freeze-dried and foam-mat-dried hens' egg powder were prepared from egg melage of uniform comp. and commercial spray dried egg powders were packed in cans and in flexible pouches under air and without air. Drying conditions and packaging materials did not significantly influence the non-enzymatic browning of phospholipid fraction of egg powders during storage (control and at 19 - 27 C) whereas high temp. (55, 42 and 37 C) had significant effect on non-enzymatic browning reaction in all 3 types of egg powders packed in cans and in flexible pouches. AS

#### Quail eggs

2205

Singh (RP) and Panda (B). **Effect of modified atmosphere packaging on the keeping quality of pickled quail eggs.** *Indian Food Packer* 45(3); 1991: 77-80.

The keeping quality of cooked and peeled quail eggs pickled in a solution consisting of 50% vinegar, 8% common salt, 0.02% tartrazine and 2% each spice mixture (containing cumin, red chilli 20% each, aniseed, cardamom, caraway, cinnamon, turmeric 10% each, clove 2.5% and black pepper 7.5%) aged for 48 h and subsequently packaged in flexible PFP (12 µm polyester/90 µm, Al foil/38 µm LDPE) laminated pouches under air (control) or modified atm. (vacuum; N gas) was investigated during 9 months storage at 19.38 C; 36-84% RH. Results revealed that pickled eggs exhibited negligible wt. loss and little fluctuation in their equilibrated pH (4.26) during the period of acceptable storage. Modified atm. packaging retarded lipid autooxidation and associated flavour deterioration, decreased aerobic bacterial counts and extended the shelf-life up to 8 months in contrast to 4 months for control. No coliforms, anaerobes, *Salmonellae* and coagulase-positive *Staphylococci* were detected in pickled eggs throughout the storage under any of the packaging system. VKR

#### SEAFOODS

2206

Osumi (Y), Harada (K), Fukuda (N), Amano (H) and Noda (H). **Changes of volatile sulphur compounds of 'Nori' products, *Porphyra* spp. during storage.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(4); 1990: 599-605

The changes in the flavour of dried and toasted laver *Paorphyra* spp. stored over 3 months were examined by focusing on the changes in 3 volatile S compounds, H<sub>2</sub>S, methyl mercaptan (MM) and dimethyl sulphide (DMS) monitored by GC. In dried laver with 8% moisture content the decline of H<sub>2</sub>S and DMS and the increase of MM were negligible only when stored at -30 C with air or at 5 C with nitrogen gas or an oxygen absorber. When the moisture content declined to 4.5%, changes in the H<sub>2</sub>S and MM levels were minimized by the nitrogen gas and by the oxygen absorber at both 5 and 25 C. DMS, however, increased with nitrogen gas at both 5 and 25 C. In toasted laver, the levels of the 3 compounds were well preserved when stored at 5 C with nitrogen gas or an oxygen absorber. At 25 C with nitrogen gas or an oxygen absorber, however, H<sub>2</sub>S and MM declined moderately. Meanwhile DMS was well preserved, resulting in the maintenance of good flavour. Therefore, the storage of all nori products at 5 C with nitrogen gas or an oxygen absorber is recommended. AS



Harada (K), Osumi (Y), Fukuda (N), Amano (H) and Noda (H). **Changes of amino acid compositions of 'Nori', *Porphyra* spp. during storage.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(4): 1990; 807-812

**Influences of moisture content, temp. and in-package gas on the quality change of dried laver 'Nori', during storage were examined for 3 months taking total free amino acid and four major free amino acid such as taurine, glutamic acid, alanine and aspartic acid as parameters. The deterioration of quality was accelerated with an increase in moisture content. In the dried laver with 9.5% and 10.5% moisture content stored at 25 C, the amino acid level declined, but not if dehydrated to less than 4.5% moisture content. The influence of temp. was negligible when the moisture content was controlled at less than 4.5%. Nitrogen gas sealing was very effective in maintaining the amino acid levels at not only 4.5% moisture content but also 9.5% at 25 C. Therefore, nori product with 4.5% moisture content can be maintained in excellent quality when stored with nitrogen gas at below 5 C.** AS

2208

Spittstoesser (DF) and Churey (JJ). **Reduction of heat resistance of *Neosartorya fisheri* ascospores by sulphur dioxide.** *Journal of Food Science* 56(3): 1991; 876-877

The presence of sulphur dioxide caused a significant reduction in heat resistance of *Neosartorya fisheri* ascospores. The 0.05 M, pH 3.3 tartaric acid was used as model solution and in various fruit juices. When the spores were heated in fruit juices they were much more resistant than in the tartaric acid solution and the effect of sulphur dioxide was less. 100 mg/l reduced D<sub>90</sub> from 123 min to 6.1 min, and at the 100 mg/l, temp. as low as 65 C caused a lethality. Raising the pH from 3.3 to 5.0 neutralized the activity of sulphur dioxide. SRA

## Carp

2209

Watabe (S), Hwang (G-C), Ushio (H), Yamanaka (H), Hatae (K), Hashimoto (K). **Short thermal treatment effect on carp myofibril and sarcoplasmic reticulum: Possible mechanisms in rigor mortis acceleration by "Arai" treatment.** *Journal of Food Science* 56(3): 1991; 653-656

Inorganic  $\gamma$ -phosphate liberation from adenosine 5'-triphosphate (ATP) by carp myofibrillar ATPase was measured at 0 - 60 C to elucidate mechanisms in rigor mortis acceleration of sliced carp muscle during washing at a moderately high temp. ATP

splitting within 20 second in the presence of 5 mM MgCl<sub>2</sub> plus 0.25 mM CaCl<sub>2</sub> was maximal at 45 C, which agreed well with the commercially adopted condition for preparing carp 'arai' muscle. In addition, the max Ca<sup>2+</sup> uptake by sarcoplasmic reticulum was observed at 50 C and decreased at higher temp. The acceleration of carp muscle rigor mortis at around 45 C was suggested to be partly due to enhancement of myofibrillar Mg<sup>2+</sup>-ATPase activity by increase of intracellular Ca<sup>2+</sup> concentration. AS

## Clams

2210

Licciardello (JJ), D'Entremont (DL) and Lundstrom (RC). **Radio-resistance of some bacterial pathogens in soft-shell clams (*Mya arenaria*) and mussels (*Mytilus edulis*).** *Journal of Food Protection* 52(6): 1989; 407-411

$\gamma$ -irradiation decimal reduction doses were determined for *E. coli*, *Salmonella typhimurium*, *Shigella flexneri*, *Strep. faecalis*, *Staph. aureus* and the Total Plate Count in a soft-shell clam or mussel substrate. Factors to be considered for designing and irradiation bacterial-decontamination process for shellfish are discussed. AS

## Crabs

2211

Crapo (CA) and Crawford (DL). **Influence of polyphosphate, soak and cooking procedures on yield and quality of dungeness crab meat.** *Journal of Food Science* 56(3): 1991; 657-659, 664

Optimum crab (*Cancer magister*) meat yield, quality and frozen storage stability was achieved by soaking raw section greater than or equal to 60, but less than or equal to 120 min in 10% polyphosphate (2 - 4 C) and then cooking in steam for a min. time for complete protein coagulation (8 min). Moisture and proteins, rich in P, retained by polyphosphate treatment and cooking in steam (rather than water) were believed to be responsible for improving meat yield, quality and storage stability. SRA

## Prawns

2212

Matsumoto (M) and Yamanaka (H). **Post-mortem biochemical changes in the muscle of kuruma prawn storage and evaluation of the freshness.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(7): 1990; 1145-1149

The changes in the content of ATP related compounds, polyamines, volatile basic nitrogen



(VBN), and lactic acid were investigated in the kuruma prawn muscle during storage at 5 C, 0 C, and -1 C in relation to freshness. During storage at low temp., ATP decreased rapidly, while AMP and IMP accumulated. Although the levels of inosine (HxR) and hypoxanthine (Hx) were low at the acceptable stage, Hx increased remarkably as decomposition progressed. The increase in K values was considerably slow and reached around 20% at the stage of initial decomposition. As for polyamines, putrescine (Put) was absent at the acceptable stage, detected in a small amount at the stage of initial decomposition, and then increased markedly at the stage of advanced decomposition. VBN increased linearly with storage time and reached 20 to 26 mg/100 g at the stage of initial decomposition. Lactic acid increased to the level of about 50 mg/100 g during storage at low temp. and decreased as the decomposition progressed. K value, VBN, and lactic acid contents appeared to be useful as potential indices for the freshness of kuruma prawn. Furthermore, Put and Hx contents seemed to be useful as decomposition indices for kuruma prawn. AS

## Shrimps

2213

Harrison (MA) and Heinsz (LJ). **Shelf-life extension of raw brown shrimp (*Penaeus aztecus*) with potassium sorbate in ices and dips.** *Journal of Food Quality* 12(3); 1989; 243-247

The shelf-life of shrimp, as indexed by psychrotrophic bacterial counts, was extended approx. 1.0, 1.9, and 3.1 days using levels of 0.05%, 0.1%, and 0.2% potassium sorbate-containing ice, resp. Shelf-life was extended by an additional 0.5 to 2.5 days when a 3% potassium sorbate dip was administered prior to storage on modified ice. In all cases, potassium sorbate extended the lag phases of the spoilage bacteria. AS

## Squids

2214

Tsai (C-H), Kong (M-S) and Pan (BS). **Water activity and temperature effects on nonenzymic browning of amino acids in dried squid and simulated model system.** *Journal of Food Science* 56(3); 1991; 665-670, 677

## Fish

2215

Malle (P) and Poumeyrol (M). **A new chemical criterion for the quality control of fish:**

**Trimethylamine/total volatile basic nitrogen (%)**. *Journal of Food Protection* 52(6); 1989; 419-423

Trimethylamine (TMA) and the total volatile basic nitrogen (TVBN) were determined in 169 samples of sea-fish (herring, cod, whiting, and mackerel) at all stages of decomposition. The comparison of these two parameters with the ratio  $P = \text{TVBN/TMA} (\%)$  showed that P provides a useful index of freshness. It is relatively constant between sp., its dispersion is less than that of TMA and it increases more rapidly than TVBN at the start of decomposition. Statistical analysis of the experimental results showed that there is a non-linear correlation between P and the decomposition index (i). The comparison of the line-equations defining log P as a function of I for different sp. of marine Teleostei led us to show that there is little or no intraspace variation of this correlation under determined conservation conditions. It is noted that for a given sp., this correlation is temp.-dependent. Statistical exploitation of these results permit us to determine the maximal admissible values for P which can be used as a support for the development of new standards. AS

2216

Flick (GJJr), Gwo (Y-Y), Ory (RL), Baran (WL), Sasiela (RJ), Boling (J), Vinnett (CH), Martin (RE), Arganosa (GC). **Effects of cooking conditions and post-preparation procedures on the quality of battered fish portions.** *Journal of Food Quality* 12(3); 1989; 227-242

The effects of different cooking conditions and post-preparation handling on quality of battered fish portions for fast food services were investigated. As the frying temp. increased from 149-204 C, the cooking time of battered fish portions decreased from 276 to 202 seconds. Crude lipid content in the batter decreased as the temp. of the frying oil increased. Holding times (10, 20 min) affected crude lipid contents of the batter depending on the cooking temp. and were lower than an unheld product. Crude lipid contents in the fish fillets were generally higher after frying by 2-3%. The crude lipid uptake by the batter coating differed significantly for the 3 frying shortenings (partially hydrogenated soybean, V-S oil; animal fat-vegetable blend, A-V Fat; and vegetable-palm oil blend, V-P oil;) compared in this study. This finding contrasts with previously published results. The amount of crude lipid uptake by the fish varied with shortening type and holding times. No consistent trend was observed to occur. Peroxide values increased after 3 days in the V-S Oil and A-V Fat. Flavour scores on battered fish portions cooked in V-S Oil, V-P oil, and A-V Fat were not statistically different immediately after cooking and after holding for 10 - +20-min on the first day. By the second day, differences were observed among



the three shortenings. Both shortening type and post-preparation holding times affected the perceived greasiness. AS

2217

Chiba (A), Hamaguchi (M), Kosaka (M), Tokuno (T), Asai (T), Chichibu (S). **Quality evaluation of fish meat by  $^{31}\text{P}$  phosphorus-nuclear magnetic resonance.** *Journal of Food Science* 56(3): 1991: 660-664

Changes in high energy phosphates in fish during storage is studied. Using  $^{31}\text{P}$ -nuclear magnetic resonance ( $^{31}\text{P}$ -NMR), changes in concn. of creatine phosphate and its degradation products, (inorganic phosphate), were examined to determine degree of fish freshness immediately after being caught. The phosphocreatine (PCr)/inorganic phosphate (Pi) ratio was found to be a sensitive index of early metabolic hypofunction. Ratios of (PCr)  $\beta$ -phosphate of ATP ( $\beta$ -ATP) and (Pi)/( $\beta$ -ATP) were demonstrated to be appropriate indexes to estimate such metabolic changes in fresh fish. The intramuscular levels of creatine phosphate, ATP and pH were maintained at higher levels in blood-drained loach than in untreated fish. The freshness of fish which were bled and washed at lower temp. were better preserved. SRA

2218

Karl (H) and Schreiber (W). **Concentrations of salt and acetic acid of fish-brine.** *Deutsche Lebensmittel-Rundschau* 86(9): 1990: 286-288 (De)

#### Alaska Pollack

2219

Ito (T), Kitada (N), Yamada (N), Seki (N) and Arai (K-I). **Biochemical changes in meat of Alaska Pollack caused by soaking in NaCl solution.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(4): 1990: 687-693

Three types of Alaska Pollack meat (fillet, mince, and surimi) were soaked in 3 M NaCl (pH 7.0) solution at 4 C. During soaking, NaCl concn., gel strength, and biochemical properties such as myofibrillar Ca-ATPase total activity along with myosin heavy chain content of meat were measured. Changing rates of these indicates were also examined. The increase in NaCl concn. of meat to give 0.8 M caused the increase in gel strength of meat, accompanied by the formation of cross-linked myosin heavy chain in it. The changes in gel strength and myosin heavy chain of surimi induced by the soaking proceeded faster than in the other two types of meat. The relatively high content of intact myosin in surimi was presumed to be responsible for these faster changes. A series of these results was very similar to the case

of salted meat paste induced by setting in a process of producing kamaboko gel. AS

#### Cod

2220

Ravesi (EM) and Krzynowek (J). **Variability of salt absorption by brine dipped fillets of cod (*Gadus morhua*), blackback flounder (*Pseudopleuronectes americanus*), and ocean perch (*Sebastes marinus*).** *Journal of Food Science* 56(3): 1991: 648-652

The degree of variability of Na content between fish of the same sp. exposed to different processing variables and between different sp. exposed to the same processing variables was studied. The varying concn. of brine were 5, 10 and 15% with 30, 60 and 90 second dip duration. The results showed that the fastest accumulation of salt occurred for all 3 sp. (fillets of cod, blackback flounder, and ocean perch) in the first 30 second brining time. 30 second dip in 15% brine resulted in greater absorption than 90 second dip in 10% brine. The skin provided an effective barrier against salt penetration. Cooking, 5 days postmortem age, brine temp. and/or frozen storage had no effect on resulting salt. A wide range of values can be offset by averaging multiple batches. Strict monitoring of time and concn. of dip should allow processors to predict reliably the approx. salt content of the final product. SRA

#### Lakera

2221

Tomek (SO), Gumuskesen (AS) and Serdaroglu (M). **The effects of curing period and the use of an antioxidant mixture on the quality of lakera (salted fish).** *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2): 1991: 15-18

Results indicate that the use of antioxidant mixture (6% propyl gallate, 14% BHT, 3% BHA, 36% vegetable oil and 36% monoglyceride citrate) improves the taste, texture, colour and odour of Lakerda and inhibits the fat oxidation. AS

#### Mackerels

2222

Okuzumi (M), Fukumoto (I) and Fujii (T). **Changes in bacterial flora and polyamines contents during storage of horse mackerel meat.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(8): 1990: 1307-1312

Results obtained indicate that the *Pseudomonas* I/II and *Pseudomonas* III/IV-NH which are known as



typical spoilage bacteria, were dominant in the bacterial flora of the spoilage stages in the samples stored at 5 C and putrescine, cadaverine and histamine were detected at high contents. On the other hand, the bacterial flora of the samples stored at 30 C showed *Vibrio* and *Photobacterium* as dominant bacteria and high contents of histamine and cadaverine were observed when the samples attained the spoilage level. The isolates from the samples were carried out on decarboxylation test in order to know qualitatively which group of bacteria produce polyamines detected in the samples. *Pseudomonas* I/II showed positive for arginine, *Pseudomonas* III/IV-NH for ornithine, *Photobacterium* for arginine and lysine and some *Vibrio* for arginine. The results suggested that *Pseudomonas* III/IV-NH produced putrescine in 5 C storage samples and *Photobacterium* produced agmatine and cadaverine in 30 C storage samples. However, no other bacteria were found which produced other polyamines detected in the samples. AS

2223

Tsukamasa (Y) and Shimizu (Y). **Setting property of sardine and Pacific mackerel meat.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(7); 1990; 1105-1112 (Ja)

Differences in the setting properties of sardine and Pacific mackerel were examined. The meat sol of sardine easily set after being kept at 20 C for only 20 min; at the same time myosin heavy chain (MHC) polymers which were insoluble in SDS formed. But that of mackerel set hardly at all in the 30-40 C range, with no MHC polymerization. The setting phenomenon of sardine seemed to be caused by transglutaminase (TGnase), as in the case of Alaska pollack, because significant inhibition of its activity was found due to the inhibitors of TGnase, EDTA and methylamine. However, TGnase activity was detected in the water soluble fraction of the muscle from seven sp. of fish including Pacific mackerel in the presence of 6 mM  $\text{CaCl}_2$ . When washed with 0.1N NaCl containing 2 mM EDTA, minced sardine meat transformed its setting property to that of Pacific mackerel. On the other hand, Pacific mackerel meat changed its setting property to that of sardine after addition of 0.1%  $\text{CaCl}_2$ . AS

2224

Takiguchi (A) and Aminaka (H). **Oxidation and hydrolysis of lipids and autolysis in salted mackerel during salting and storage.** *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(4); 1990; 613-618

Mackerel (*Scomber japonicus*) salted for 10 days showed an increase in the peroxide value (POV),

however, the oxidized acid content and the fatty acid composition of the lipid did not change. The bulk of polar lipid was hydrolysed to release free fatty acids during salting. Contents of free amino acids in the muscle increased in varying extents due to autolysis, with some exceptional cases. Histidine and taurine decreased in the contents in the first 7 days of salting. During storage for 56 days, moisture content in the non-packaged salted product decreased from 49% to 39%, while that in the packaged salted one remained unchanged. Lipid oxidation in the non-packaged product proceeded rapidly as judged by POV, oxidized acid content. Highly unsaturated fatty acids of lipid decreased in amount. But the packaged product underwent little lipid oxidation. Total extractive nitrogen and free amino acid contents increased slowly in the non-packaged product, but rapidly in the packaged one. These findings, show that autolysis in the salted mackerel proceeds rapidly during storage at an ambient temp. but is inhibited markedly when the moisture content of the product decreases to some extent due to drying. BV

2225

Sachindra (NM) and Sripathy (NV). **Bacterial profile of salted, sun-dried mackerel: Changes during processing and storage.** *Indian Journal of Microbiology* 31(2); 1991; 191-196

Fresh mackerel of local market were salted and sun-dried and stored for 15 days. Analysis was done from (i) fresh fish, just before salting; (ii) salted fish, after 24 h salting and light rinsing with water; (iii) partially dried fish, after 7 h of sun-drying, (v) stored sun-dried fish, 15 days after drying. Total plate count, total mould count, coliform count, coagulase positive *Staphylococci* count and incidence of *Salmonella* were determined. Results showed that total bacterial load increased after salting but decreased thereafter on drying and subsequent storage. *Micrococci* and *Staphylococci* were dominant at all stages of processing. During storage, the incidence of Gram positive rods increased. The storage RH did not show marked effect on the distribution of microflora; but the total bacterial load decreased during storage. Commercial samples were dominated by *Micrococci* and *Staphylococci*. SRA

## Perch

2226

Vidya Sagar Reddy (G) and Srikar (LN). **Effect of ice storage on protein and related changes in pink perch (*Nemipterus japonicus*).** *Journal of Food Science and Technology (India)* 28(2); 1991; 101-104



Significant ( $P < 0.05$ ) decreases in total N, non-protein N, salt soluble proteins, water soluble proteins and total proteins were observed during the ice storage of pink perch. Total plate count showed a gradual increase throughout the ice storage period. The increase in  $\alpha$ -amino N content was significant ( $P < 0.05$ ) upto 5 days storage. Electrophoretic studies indicated alterations in sarcoplasmic and myofibrillar proteins during storage. Significant correlations ( $P < 0.05$ ) existed between the mean sensory scores for texture and the protein changes. The product was found acceptable upto 12.5 days storage. AS

#### Rainbow trout

2227

German (JB), Berger (RG) and Drawert (F). Generation of fresh fish flavour: Rainbow trout (*Salmo gairdneri*) gill homogenate as a model system. *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2): 1991: 19-24

The volatile neutral constituents of trout gill homogenate comprised numerous aliphatic hydrocarbons, alcohols, carbonyls and acids. The spectrum of volatiles was similar to those reported for whole freshwater fish. Strong odour impressions were contributed by trace compounds such as (2E)-pentenal, (2E,6Z)-nonadienal, 1-octen-3-one, (1,5Z)-octadien-3-one, (1,3E,5Z)-undecatriene and (1,3E,5Z,8Z)-undeca-tetraene. Data obtained by adding a lipoxygenase inhibitor (esculetin) or precursor fatty acids (20:4n6 or 22:6n3) to the homogenate suggested that the plant and sea-like odour attributes of fresh fish originated from the initial action of endogenous lipoxygenases with different positional specificity. A more concerted technology could make use of processing wastes of the fish industries to biogenerate fresh fish flavours for seafood products. AS

#### Sardine

2228

Kasahara (K), Itaya (M) and Nishibori (K). Effect of soy sauce flavouring on improvement of sardine odour in 'Mirin-boshi'. *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(4): 1990: 619-623

The suppression of sardine odour in "mirin-boshi" by addition of soy sauce was studied by a combination of sensory test, GC and GC-MS. Results of sensory evaluation revealed that the fishy odour of "mirin-boshi" flavoured with mirin was not affected, but that flavoured with mirin containing soy sauce was suppressed. GC of sample of

mirin-boshi flavoured with mirin containing soy sauce

#### Products

##### Fish

##### Sausages

2229

Nishino (H), Tanaka (M) and Yokoyama (M). The influence of retort conditions on meat adhesion of fish sausage. *Bulletin of the Japanese Society of Scientific Fisheries (Nihon Suisan Gakkai-shi)* 56(8): 1990: 1239-1244 (Ja)

The adhesion of meat to casing was investigated using fish meat sausage heat-treated under several different retort conditions. A polyvinylidenechloride-vinylchloride co-polymer tube (26 mm in dia.) was used as casing. The degree of meat adhesion was expressed in terms of the adhesive strength and the attached meat wt. to the casing. When sausage was heat-treated at a fixed temp. (120 C) and for different lengths of time, the degree of meat adhesion reached a max. in 5 min and subsequently fell. The jelly strength and breaking strength gave the same pattern. When sausage was sterilized at different temp. between 100 C and 130 C for a fixed time (15 min), the degree of meat adhesion increased with a rise in temp. It was the same for the jelly strength and breaking strength. Thus the adhesive strength depended on the intrinsic binding force of meat, because peeling of the casing was attended by the breaking of meat coagulation. There was a good correlation between meat adhesion and jelly strength or breaking strength. AS

#### PROTEIN FOODS

##### Infant foods

2230

Fligner (KL), Fligner (MA) and Mangino (ME). The effects of compositional factors on the short-term physical stability of a concentrated infant formula. *Food Hydrocolloids* 4(2): 1990: 95-104

Multiple regression analysis was used to evaluate the relationship of phospholipid and carrageenan levels and the casein-to-whey protein ratio on the physical stability of emulsions simulating commercially sterile, concentrated infant formula containing 7.0% fat and 4.5% protein. Assessment of emulsion stability included the extent of



gravitational and centrifugal creaming, the av. fat globule diameter and an emulsion activity index derived from light scattering. The level of independent variables required to maximize stability varied depending on the method used. However, all methods showed that protein type was more important than phospholipid or carrageenan in controlling emulsion stability. Av. particle size and emulsion activity index were inadequate predictors of short-term emulsion stability. AS

## ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES

2231

Bhalerao (SD), Mulmuley (GV), Ananthakrishna (SM) and Potty (VH). **Waste and waste water management in food industry. III. Fermentation and beverage industry.** *Indian Food Packer* 45(3); 1991: 19-37

Type and quality of waste produced from the distillery, method of treatment, utilization and disposal of waste, solids recovery, agricultural utilization, biological waste water treatment process including aerobic and anaerobic have been reviewed. Another fermentation industry is yeast factories, the quality of the waste produced and the treatment process have been indicated. Breweries also contribute waste water and their treatment process have been covered. Soft drink producing industry also produce substantial quantity of waste water, its chem. characteristics and treatment methods are briefly indicated. 62 references. VKR

2232

Hernandez (E), Baker (RA) and Crandall (PG). **Model for evaluating turbidity in cloudy beverage.** *Journal of Food Science* 56(3); 1991: 747-750

In this investigation, the effect of size and concn. (ranging from 0.10 to 5.85  $\mu\text{m}$ ) suspended globules on turbidity of a cloudy beverage using uniform latex particles (ULP) to simulate the diluted cloud emulsion was determined. Turbidity measurements showed that, for a given particle concn., the haze of a diluted suspension reached a max. when the diameter of the ULP was decreased to 0.2 - 0.3  $\mu\text{m}$ . The results compared well with turbidity analysis of commonly used citrus oil in water cloud base emulsions. SRA

### Alcoholic beverages

#### Beer

2233

Agu (RC) and Obanu (ZA). **Studies on beer production from Nigerian millet.** *Journal of Food Science and Technology (India)* 28(2); 1991: 81-83

All malt lager beer was brewed from Nigerian millet using the upward infusion method for wort production. The beer produced from millet compared favourably with the commercial beers brewed from barley malt except sparkling colour as confirmed by sensory evaluation. AS

#### Liquor

2234

Zariwala (MBA), Lalitha (VS) and Bhide (SV). **Carcinogenic potential of Indian alcoholic beverages (country liquor).** *Indian Journal of Experimental Biology* 29(8); 1991: 738-743

One brand of country liquor from Maharashtra State, India was tested for its carcinogenicity in two strains of mice and Syrian golden hamsters. Animals were fed with 10% liquor in drinking water from 2 months of age for 16 months. One % ethanol treated animals served as controls. With long term bioassays, the transplacental carcinogenic effect of country liquor in the offspring of treated mothers, as well as in the breeders themselves was also investigated. Pregnant mothers were fed 10% liquor through drinking water from 12th day of gestation till weaning of the progeny. Later, off springs were allowed to live without further treatment and mothers continued to get liquor treatment. In long term bioassays, liquor caused 22% total tumor incidence in mole BALB/c mice and 28% in male Swiss mice. Female Swiss mice and hamsters did not show any pronounced effect on tumor incidence. The offspring of treated mothers showed similar negative results, but the offspring of liquor treated mothers had higher mortality prior to weaning than the untreated mothers. SRA

#### Wines

2235

Enkelmann (R). **Release of trace elements from wine processing aids. Part 4. Infusorial earth.** *Deutsche Lebensmittel-Rundschau* 86(10); 1990: 314-321 (De)

Twenty-two commercial infusorial earths were investigated on the release of Cu, Zn, Fe, Mn, Cr, Ni, Pb, Cd, As and Al to both boiling nitric acid and 1% tartaric acid solution. The expected increases in the wine caused by infusorial earth filtration with 300 g/hl were calculated. The majority of the products release only traces of the ten metals into the tartaric acid solutions. The increases in the wine caused by



these products are negligible. The use of 4 siliceous earths, however, resulted in a considerable increase in Fe concn. in the wine (on av. 3.6 mg/l) so that Moalinger fining will be necessary. Furthermore, these as well as 4 other products caused a considerable increase in the Al concn. in the wine (on av. 2.37 mg/l). The concn. limit stipulated by the German drinking water conservation legislation was exceeded by a factor 15, and the values were 38% of the range allowed in the German wine quality legislation. The release of Mn caused by two of the earths investigated was a factor of 20 less than the release of Al. 10 of the earths investigated also showed a considerable increase in the Cr concn. in the wine. The natural concn. of Cr in wine was exceeded by a factor of 4.5 corresponding to 60% of the limit allowed in the German drinking water conservation legislation. The increase in the wine caused by the other 6 trace metals are negligible. AS

2236

Hupf (H) and Jahr (D). **Styrene contents in foreign wines.** *Deutsche Lebensmittel-Rundschau* 86(10): 1990: 321-322 (De)

In 168 wines originating from 12 countries the contents of monostyrene by means of headspace capillary GC/MS was determined with a detection limit of 0.08 µg/l. The max. found was 7.8 µg/l. In 29% of the products, no styrene at all could be detected. Comments are presented on its limitation in wines of commercially available standards. AS

## Non-alcoholic beverages

### Fruit juices

2237

Kalra (SK), Tandon (DK), Garg (N) and Singh (BP). **Quality evaluation of some market fruit drinks.** *Indian Food Packer* 45(3): 1991: 48-53

6 mango and 2 guava drinks sold in Lucknow, India, were evaluated for quality, microbial load at zero time and after 6 months storage at room temp. (26-37 C). The analysis indicated that those with 14 - 16% total soluble solids and 0.21 - 0.24% acidity remained stable during storage. Sensory evaluation showed that all mango drinks contained artificial flavour uncharacteristic of natural mango flavour. The Hunter's a and b values of the market drinks were comparable with the drinks prepared in lab. The decrease in L and b values and increase in a value during storage was more in market drinks than in lab. drinks and vitamin C reduced to < 50% during 6 months storage in all drinks. Market drinks had low sensory scores except three samples. There was no apparent spoilage during storage: initial aerobic plate count showed the presence of

mould, yeast and bacteria. After 6 months storage the microbial load declined in all the drinks. Microorganisms isolated are non-pathogenic and they are listed in tabular form. V.R.K

### Orange juices

2238

Balaban (MO), Arreola (AG), Marshall (M), Peplow (A), Wei (CI), Cornell (J). **Inactivation of pectinesterase in orange juice by supercritical carbon dioxide.** *Journal of Food Science* 56(3): 1991: 743-746, 750

The effect of supercritical carbon dioxide (SC CO<sub>2</sub>) treatment conditions (time, temp. and pressure) on degree of inactivation of pectinesterase (PE) in single strength orange juice (SSOJ) has been studied. The kinetics of inactivation were determined. Results indicated that PE could be inactivated by high pressure CO<sub>2</sub>. Higher pressure, temp. or longer time resulted in more inactivation. The activation energy for the 'reaction' was reduced significantly when the pressure was increased to 31 MPa from atm. At a given temp., increasing the pressure resulted in decrease of D value for inactivation. D value ranged from 2673 min at atmospheric pressure and 40 C to 10 min at 31 MPa and 60 C. Z value at atm. pressure was 8.8 C, and at 31 MPa 5.2 C. This method may be used as an alternative to heat for enzyme inactivation in foods and beverages. SRA

2239

Shaw (PE) and Moshonas (MG). **Ascorbic acid retention in orange juice stored under simulated consumer home conditions.** *Journal of Food Science* 56(3): 1991: 867-868

Results of this study on effects of simulated home use on vitamin C (AA) retention showed that in 6 of the 14 samples analysed, a significant difference was seen in rate of AA degradation between the C and P samples. No appreciable difference in AA retention was found after 5-7 days refrigerated storage (4.5 C) in original container and in plastic pitcher with open top. The av. % retention at the end of storage period (5-7 days) was 88% and 67% after 2 wk in both original and plastic pitcher containers. SRA

## FATS AND OILS

2240

Clark (WL) and Serbia (GW). **Safety aspects of frying fats and oils.** *Food Technology* 45(2): 1991: 84-89, 94



Covers briefly reactions of fats and oils, types of reactions during frying (autooxidation, thermal oxidation and polymerization), fractionated and simulated frying studies, cancer and mutagenesis, commercially used fats, process-oriented frying research, and lipid oxidation products. BV

2241

Firestone (D), Stier (RF) and Blumenthal (MM). **Regulation of frying fats and oils.** *Food Technology* 45(2); 1991; 90-94

This article considers a variety of analytical methods specified by the Government of US and other countries to control the use of frying fats and oils in food establishments. Aspects covered include analytical methods, legislation and regulations in the US, regulations in other countries and quality expected to increase. BV

2242

Koelsch (CM), Downes (TW) and Labuza (TP). **Hexanal formation via lipid oxidation as a function of oxygen concentration: Measurement and kinetics.** *Journal of Food Science* 56(3); 1991; 816-820, 834

A continuous system to quantify lipid oxidation at constant oxygen concn. by continuously monitoring the rate of hexanal formation as an index of lipid oxidation, was developed and data were then analysed based on both curve fitting equations and kinetic models developed for the molecular mechanism of hexanal formation as a function of oxygen concn. in the headspace. The kinetic models illustrated the mechanistic influence of oxygen on rate constants and fit the data as well as simplistic curve fitting models. The monomolecular reaction phase showed the expected hyperbolic fit of inverse rate vs reciprocal oxygen concn. The break point between initial and accelerated stages as function of oxygen concn. was represented by a log-arithmetic function. SRA

#### Fats

2243

Blumenthal (MM). **A new look at the chemistry and physics of deep-fat frying.** *Food Technology* 45(2); 1991; 68-71, 94

2244

Jacobson (GA). **Quality control in deep-fat frying operations.** *Food Technology* 45(2); 1991; 72-74

This article reviews aspects like commercial deep-fat frying including frying equipment and procedures,

the choice and maintenance of high quality in the frying medium, and some methods of studying overall frying performance. 13 references. BV

2245

Carr (RA). **Development of deep-frying fats.** *Food Technology* 45(2); 1991; 95-96

Fat substitutes, sources of raw materials, speciality crops, canola and canola frying performance (var. and corn oil replacement) are the aspects covered in this article. BV

2246

Megremis (CJ). **Medium-chain triglycerides: A nonconventional fat.** *Food Technology* 45(2); 1991; 108-110, 114

The properties and applications (flavours, confections, reduced-calorie foods, and speciality nutrition foods) of medium-chain triglycerides are discussed. BV

2247

Farag (RS), Hassan (MNA), El-Baroty (GSA) and Abd El-Aziz (NM). **Influence of jojoba fatty alcohols on butter and refined cottonseed oil rancidity.** *Chemie Mikrobiologie Technologie der Lebensmittel* 13(1/2); 1991; 7-14

Some physical and chem. constants of jojoba liquid wax were determined. This wax contained unusual amounts of unsaponifiables (31.2 - 47.7%). Chem., spectroscopic, and chromatographic analyses indicated that the jojoba unsaponifiables contained straight chains of monounsaturated alcohols of C 20:1, C 22:1, and C 24:1. Simple model systems composed of butter or refined cottonseed oil and jojoba fatty alcohols were designated to study their antihydrolytic and anti-oxidative properties, resp. The data of acid value, lipase activity, and total lipolytic bacterial counts indicated that jojoba fatty alcohols caused no effect on preventing butter hydrolytic rancidity due to their low OH:C ratio. Conversely, jojoba fatty alcohols and in particular at 600 p.p.m. produced an antioxidant power nearly similar to that produced by butyl hydroxy toluene at 200 p.p.m. Consequently, jojoba fatty alcohols can be considered as a reasonable alternative source of synthetic antioxidants since they are generally recognized as safe for use by mutagenicity test. AS

#### Oils

2248

White (PJ). **Methods for measuring changes in deep-fat frying oils.** *Food Technology* 45(2); 1991; 75-80



This review covers the methods available for studying changes that take place during deep-fat frying. Changes in fats during heating, measurement of heat abuse of oils (volatile decomposition products and non-volatile decomposition products), methods (standard methods), polar components (conjugated dienoic acids, fatty acid analysis and 18:2/16:0 ratio); quick tests (dielectric constants, Rau-test, Fritest and Spot test), complex procedures (GLC and exclusion chromatography), comparison of methods and choice of method are the aspects discussed. 60 references. BV

2249

Neelima (A) and Sarojini (G). **Quality of extracted oil from some commercially sold deep-fat-fried snacks and used oil.** *Journal of Food Science and Technology (India)* 28(2): 1991: 108-109

Free fatty acids (FFA), peroxide value (PV) and Iodine value (IV) of fat extracted from 4 commonly sold savoury products and those of oil used for frying, collected from the sweetmeat shops were studied. For a comparative study, the savoury products were similarly prepared in the laboratory and the product-absorbed oil, the oil used for frying and the fresh oil were also assessed for these characteristics. The mean fat content of the products collected from shops ranged from 24.9 - 43.6%. Its FFA, PV and IV were in the range of 0.97 - 1.52%; 13 - 29.1 meq oxygen/kg oil and 84.8 - 95.8 resp. The savoury products prepared in the laboratory were found to be relatively superior in quality as the oil in these products contained much lower FFA and PV than similar savoury products collected from the market. AS

2250

Perez (FY), Sans (RG) and Chozas (MG). **A comparative study of the precision of some methods for evaluating oxidative degradation in edible vegetable oils.** *Grasas y Aceites* 41(2): 1990: 163-166 (Es)

In this work a study about the precision of some methods (peroxide value, oxirane-oxygen detn., anisidine value, TBA number) proposed for evaluating oxidative degradation of different edible vegetable oils (olive oil, refined sunflower oil, refined soybean oil) is carried out. The mean values and the more characteristics statistics are presented. A higher precision is reached for olive oil samples. From ANOVA it is concluded that there is a significant difference ( $P < 0.01$ ) among the different methods when they were applied simultaneously. The type of studied oil does not exert a significant effect ( $P < 0.05$ ). AS

2251

Blicher-Mathiesen (U) and Balslev (H). ***Attalea colenda* (Arecaceae), a potential lauric oil resource.** *Economic Botany* 44(3): 1990: 360-368

The oil content of the *Attalea colenda*, (a palm tree native to the coastal plain) seeds is 56-90% dry wt. Kernel oil production per year in fructescence is 7 - 16 kg. A hectare with 50 trees can produce between 0.35 and 0.32 tons of oil per year. The kernel oil is chemically similar to coconut oil and kernel oil from the African oil palm. The increasing demand for lauric oil on the world market makes *A. colenda* a potential oil source. SRA

#### Cottonseed oils

2252

Zaher (FA), Hawash (S) and Diwani (GE). **Semi-pilot study on the refining of cottonseed oil in miscella.** *Grasas y Aceites* 41(2): 1990: 139-143

A semi-pilot study on the refining of crude cottonseed oil in miscella as compared to the conventional refining process was carried out. The effects of miscella concn., strength and quantity of the alkali used on the refined and bleached oils colour as well as the refining losses were investigated. The optimum miscella concn. was found to be 80% oil in miscella rather than 50%, the optimum concn. for a bench scale refining. The colour indices of the refined and bleached oils could be reduced from 260 and 118, resp. by conventional refining to 160 and 40 by refining in 80% miscella. The refining oil losses could also be reduced from 16.1 to 9.8% which is equivalent to 40% saving in oil losses. Alkali solutions as strong as 36 Brix were unrecommended for miscella refining since the separation of soapstock from the refined oil was almost unsuccessful with such solutions. AS

2253

El-Nomaany (HM), El-Shami (SM) and Zaher (FA). **Characteristics of SOS-7 halophyte oil and its oxidative stability compared to cottonseed oil.** *Grasas y Aceites* 41(2): 1990: 154-157 (Es)

The potential of SOS-7 halophyte oil as an edible oil was evaluated in comparison with cottonseed oil, the major vegetable oil processed in Egypt. The parameters considered in the comparison were the oil characteristics and its stability to oxidation in the crude or processed states. The oxidation of the crude, refined and bleached oils was studied when the oxidation process is mass transfer controlled and when it is rather controlled by the chem. reaction step. The results have shown that the



stability of crude SOS-7 oil to oxidation is much lower than that of crude cottonseed oil. The oxidation of the former is most likely mass transfer controlled whereas that of the latter is chem. reaction-controlled. Unlike the crude oil, the stabilities of refined and bleached SOS-7 oils to oxidation are comparable to those of refined and bleached cottonseed oils. AS

#### Groundnut oils

2254

Seema Sarnaik, Godbole (SH) and Pradnya Kanekar. **Quality of marketed groundnut oils in comparison to ISI standards.** *Indian Food Packer* 45(3); 1991; 43-47

26 unrefined groundnut oil (UGO), 7 refined groundnut oil (RGO) and 7 groundnut oil distributed through public distribution system were analysed for moisture content and acid value. Among the 26 UGO only three were devoid of moisture and the others had moisture between 0.117 and 1.214 g % and acid value of 0.748 - 17.694 mg KOH/g. The RGO samples contained 0.064 - 0.405 g % moisture and had acid value of 0.249 - 9.345 mg KOH/g. The 7 groundnut oil samples distributed through public distribution had contained 0.213 - 0.650 g % moisture and had an acid value of 1.310 - 28.035 mg KOH/g. Only 27.5% samples satisfied the prescribed standards for both moisture and acid value, 15% for moisture and 12.5% for acid value alone; 45% samples did not satisfy the standards prescribed for both the parameters. VKR

#### Soybean oils

2255

Jung (MY), Choe (E) and Min (DB).  **$\alpha$ -,  $\gamma$ - and  $\delta$ -Tocopherol effects on chlorophyll photosensitized oxidation of soybean oil.** *Journal of Food Science* 56(3); 1991; 807-810, 815

The effect of 0, 1.0, 2.0 and 4.0 ( $\times 10^{-3}$  M)  $\alpha$ -,  $\gamma$ - or  $\delta$ -tocopherol on chlorophyll b photosensitized oxidation of soybean oil in methylene chloride were studied by peroxide values and headspace oxygen. As concn. of tocopherols increased, peroxide values decreased and headspace oxygen increased (P 0.05). At  $1.0 \times 10^{-3}$  M,  $\alpha$ -tocopherol showed highest antioxidant effect,  $\gamma$ -tocopherol second and then  $\delta$ -tocopherol.  $\alpha$ - and  $\gamma$ -tocopherols had similar effects and  $\delta$ -tocopherol had lower effect at  $2.0 \times 10^{-3}$  M (P < 0.05). However, the 3 tocopherols were not different (P > 0.05) at  $4.0 \times 10^{-3}$  M.  $\alpha$ -Tocopherol quenched singlet oxygen to reduce the photosensitized oxidation of oil. The quenching rate constants of  $\alpha$ -tocopherol were  $2.7 \times 10^7 \text{ M}^{-1} \text{ sec}^{-1}$

by peroxide value and  $2.6 \times 10^7 \text{ M}^{-1} \text{ sec}^{-1}$  by headspace oxygen. AS

### SPICES AND CONDIMENTS

2256

Malmsten (T), Paakkonen (K) and Hyvonen (L). **Packaging and storage effects on microbiological quality of dried herbs.** *Journal of Food Science* 56(3); 1991; 873-875

Two hundred herb (dill, basil, marjoram and wild marjoram) samples were evaluated for microbiological quality and for the effect of drying method, type of package and storage conditions. Molds and aerobic sporeformers (*Bacillus cereus* in particular) were detected in almost all samples. The aerobic plate count (APC) ranged from  $6.4 \times 10^3$  to  $2.9 \times 10^7$  organisms/g dried material. After 1 yr of storage, the APC of air-dried dill and basil was 10 times higher than that of the freeze-dried samples. Microbial counts of herbs were higher in vacuum packaged than those containing oxygen. In freeze-dried herbs, there was no significant difference in APC values between samples stored for 1 and 2 yr at 23 C. The microbial counts were higher at 23 C than at 35 C. The drying method, type of packaging and storage conditions had clear effects on microbial quality. SRA

#### Spices

2257

Balakrishnan (KV). **An insight into spice extractives.** *Indian Spices* 28(2); 1991; 22-26

Describes the drawbacks in the use of whole spices and ground spices and the advantages of spice extractives. The method of production and the advantages of each of the essential oil, oleoresin and derivatives of these which includes encapsulated forms also have been described. Quality control to be observed during spice oil and oleoresin manufacture is also indicated. The Research and Development in spice in India is concentrated on product development, search for new products, and review of International Standards/Methods of evaluation. The advantages of spice oils and oleoresin with respect to economy, hygiene, stability of flavour, uniformity of flavour and storage have been briefly indicated. The use of spice oils and oleoresins is also briefly mentioned. GS



2258

Verghese (J). **Snapshots on *Piper nigrum* L. technology.** *Indian Spices* 28(2): 1991: 12-16

The paper reviews blanching-cum-drying techniques of pepper berries; advanced systems for thermal decontamination of black white pepper; improved flavour system with acceptable microbial profile; treatment of spice to preserve volatiles and making mild spice; polyhydric alcohol base extract by dual extraction of spice; oleoresin, green pepper oil by steam distillation of green berries; CO<sub>2</sub> extracted pepper oil with pale blue-green colour; and technology to stabilize the green colour of pepper berries to make dehydrated green pepper. GS

## Piperine

2259

Muralidhara and Narasimhamurthy (K). **Lack of genotoxic effects of piperine, (the active principle of black pepper) in albino mice.** *Journal of Food Safety* 11(1): 1990: 39-48

The potency of piperine, the active principle of black pepper to induce micronuclei in bone-marrow erythrocytes and dominant-lethal mutations was investigated in male mice. Piperine induced no significant increases in micronuclei in polychromatic erythrocytes suggesting its non-clastogenic nature at the tested doses. KMA

## Tamarind

### Tamarind powder

2260

Manjunath (MN), Sattigeri (VD), Rama Rao (SN), Usha Rani (M) and Nagaraja (KV). **Physico-chemical composition of commercial tamarind powder.** *Indian Food Packer* 45(3): 1991: 39-42

Commercial samples (16) of tamarind pulp powder were analysed; the range of values for moisture was 3.5 - 8.8%, added starch 23.0 - 41.3%, water insoluble solids 9.9 - 22.2%, and total reducing sugar 18.6 - 25.0%. The samples contained 74 - 143 mg % Ca, 23.8 - 27.7 mg % K and 1.2 - 3.4 p.p.m. Cu. This data is used in proposing quality standards for tamarind powder under FPO in India. VKR

## SENSORY EVALUATION

2261

O'Mahony (M), Rothman (L), Ellison (P), Shaw (D) and Buteau (L). **Taste descriptive analysis. Concept formation, alignment and appropriateness.** *Journal of Sensory Studies* 5(2): 1990: 71-103

Taste profiling was tested and found not to produce concept alignment with an agreed set of labels. The procedure also tested after the panelists were trained using a concept alignment involving 50 standards did not define the concepts of 'sweet', 'sour', 'salty' and 'bitter' leading to the conclusion that it is inferior to the currently used descriptive methods. SD

2262

Powers (JJ), Ware (GO) and Shinholser (K). **Magnitude estimation with and without re-scaling.** *Journal of Sensory Studies* 5(2): 1990: 105-115

Magnitude estimation (ME) data provided by 173 panelists on 18 geometric figures subjected to a full ANOVA showed that the residuals of the ME transformed to logarithms conformed essentially to a normal distribution with greater Kurtosis and less than 10% of coeff. of variation. Also it was found that in order to account for total variability partitioning of the sources of variation should be exhaustive and that rescaling of data to arithmetic mean was not necessary as it increased the error more than the geometric mean. SD

2263

Newton Yau (NJ) and McDaniel (MR). **The power function of carbonation.** *Journal of Sensory Studies* 5(2): 1990: 117-128

A trained panel assessed the intensity of carbonation by magnitude estimation in 5 levels of carbonated spring water using swallowing and expectoration. Both swallowing (exponent 2.79) and expectoration (exponent 2.65) were found comparable being highly correlated to carbonation. SD

2264

Hoffheins (BS) and Lauf (RJ). **Use of chemical sensor arrays for food and fragrance analysis.** *Journal of Sensory Studies* 5(2): 1990: 129-144

A gas sensor array was constructed and various mixtures tested. Since gasoline-alcohol mixtures demonstrated that the signatures did not follow a rule of mixing, the behaviour of alcohol-water mixtures when examined for possible quality control



in the distilling industry, was found that the signature of alcohol dominated even at 10% low concn. The prototype sensor array was preliminarily experimented to see if it could be used to automatically detect rancidity in dairy products and also to characterize the behaviour of representative classes of some flavourings and essential oils in order to understand their signatures on the basis of their constituents. SD

2265

Ishii (R) and O'Mahony (M). **Use of multiple standards to define sensory characteristics for descriptive analysis: Aspects of concept formation.** *Journal of Food Science* 56(3); 1991: 838-842

As a standardization procedure for judges, prior to descriptive analysis, a set of standards gave superior concept alignment to a single standard in the definition of a given beverage descriptor. Some of the standards defined stimuli which were to be included in the concept of the beverage flavour while others defined stimuli which were sufficiently different not to be included. Multiple rather than single standards might be suitable reference samples to define sensory characteristics for descriptive analysis. AS

#### FOOD STORAGE

2266

Golob (P) and Eisendrath (SE). **Training extension workers in food conservation using drama and other informal techniques.** *Tropical Science* 30(2); 1990; 195-205

#### INFESTATION CONTROL AND PESTICIDES

2267

Blanco (LR), Kotaki (T) and Nakakita (H). **Sexual maturity and sterilizing effect of gamma-irradiation in *Tribolium freemani* Hinton.** *Report of the National Food Research Institute (Japan)* 54(2); 1990; 18-22

Sexual maturity, spermatogenesis and the sterilizing effect of gamma-irradiation in *Tribolium freemani* were studied. In single-pair matings of the young (1 day-old) and the old (10 day-old) for 31 days at 30 C and 70% R.H., both male and female could mature sexually by the 9th day of adult life. In the male reproductive system, testis consists of 6 lobes assembled at the distal end of vas deferens in a similar manner as that of other *Tribolium* spp. Irradiation with a dose of 100 Gy at 1 to 5 day-old

insects completely sterilized both sexes. Spermatogonial death was observed in testes of the irradiated male. AS

#### BIOCHEMISTRY AND NUTRITION

2268

Britten (M) and Giroux (HJ). **Coalescence index of protein-stabilized emulsions.** *Journal of Food Science* 56(3); 1991: 792-795

A simple method is proposed to estimate coalescence stability of protein-stabilized emulsions. Coalescence was accelerated through agitation and measured by change in emulsion turbidity over time. A coalescence index (CI) was determined and used to compare emulsions stabilized with casein, whey (WPI) and soy protein isolates (SPI). CI increased when stirring rate increased. Casein produced more stable emulsions, followed by WPI and SPI. High homogenization pressure increased coalescence stability of WPI and SPI-stabilized emulsions and decreased coalescence stability of casein-stabilized emulsions. Microscopic examination, showed agitation of the emulsion had clearly induced formation of large oil droplets which acted as coalescence nuclei. AS

2269

Emanuel (HA), Hassel (CA), Addis (PB), Bergmann (SD) and Zavoral (JH). **Plasma cholesterol oxidation products (oxysterols) in human subjects fed a meal rich in oxysterols.** *Journal of Food Science* 56(3); 1991: 843-847

There is no evidence whether humans absorb cholesterol oxidation products (COPS) from food sources. Therefore, (after-meal) absorption of COPS in humans was studied following consumption of a powdered egg meal containing 30 - 90 p.p.m. each of 4 different COPS. Both total plasma and plasma chylomicron COPS concn. increased. By contrast, subjects consuming fresh eggs containing very low levels of the same 4 COPS (0 - 2 p.p.m.) demonstrated no significant rise in plasma COPS. It was concluded that the human subjects studied had the capacity to absorb COPS from food sources. The brief residence time of COPS observed in both chylomicrons and plasma suggested rapid transfer of COPS among lipoprotein fractions and/or clearance from plasma. AS

2270

Autio (K), Saito (M), Kohyama (K) and Nishinar (K). **Globin protein gelation: the effect of pH and temperature.** *Food Hydrocolloids* 4(2); 1990; 87-93



In contrast to other globular proteins, bovine globin forms a gel at low concn. Although this property is of practical importance, there have been no studies on the gelation mechanism of globin. The structural properties of globin solutions were studied by fluorescence measurement, circular dichroism (CD) and ultracentrifugal analysis and the heat-induced gelation was investigated by dynamic viscoelasticity measurements. At low pH ( $< 5.0$ ) both the rate constant of gelation and  $G'$  were lower than at high pH values. CD and fluorescence analysis suggest that globin is more unfolded and more flexible at low pH values. When  $G'$  was measured as a function of temp., two peaks were observed suggesting that two different kinds of network structures are formed: a less ordered random structure above 60 °C and a more ordered structure above 85 °C. The former is typical for high pH gels (pH 5.7) and the latter for low pH gels (pH 4.7). AS

2271

Stading (M) and Hermansson (A-M). **Viscoelastic behaviour of  $\beta$ -lactoglobulin gel structures.** *Food Hydrocolloids* 4(2): 1990; 121-135

The viscoelastic properties of  $\beta$ -lactoglobulin gels, made by dissolution of  $\beta$ -lactoglobulin in distilled water, have been investigated by dynamic rheological measurements at pH 2.5 - 9.0. Gels formed at pH 4 - 6 were opaque and have been defined as aggregate or particle gels; at pH below or above this range gels were transparent and have been defined as fine-stranded gels. The aggregate gels were more strain sensitive during gelation and more frequency dependent than the fine-stranded gels. They also had a higher storage modulus than the fine-stranded gels at a constant  $\beta$ -lactoglobulin concn. of 12% (w/w). The critical concn. for gel formation was lower for the aggregate gels than for the fine-stranded gels, and as low as 1% in the pH range 4.5 - 5.5. This indicates a very open structure. The onset of gelation of 12%  $\beta$ -lactoglobulin gels at intermediate pH, when measured as  $G' = G''$  at 1 Hz or as the development of a measurable  $G'$  takes place at temp. far below the temp. of denaturation. This is not the case at higher or lower pH, where the onset of gelation is above the temp. of denaturation. The heating rate during gel formation was varied between 0.008 and 1 °C/min. The gelation temp. of the fine-stranded gels was found to increase with an increasing heating rate. AS

2272

Reichert (N) and Rubach (K). **Determination of vitamin B<sub>12</sub> in foodstuffs with vitamin additives based on a competitive binding protein assay and an ELISA.** *Deutsche Lebensmittel-Rundschau* 86(10): 1990; 307-310 (De)

This work describes the development and optimisation of two tests for the measurement of vitamin B<sub>12</sub> based on a competitive binding protein assay. For this purpose vitamin B<sub>12</sub> was bound to horseradish peroxidase. A naturally occurring binding protein (Non-Intrinsic-Factor), or a commercially available antibody was used for the quantification. Results were then compared. Assays thus optimized may be used for the detn. of vitamin B<sub>12</sub> content in foodstuffs with vitamin additives (fruit juice, breakfast cereals, marmalade, powdered drink mixtures etc.). AS

2273

Poth (B) and Gebhardt (E). **Methods of dietary fibre determination.** *Ernährungsforschung* 35(4): 1990; 117-121 (De)

Amongst the briefly presented methods which have been developed up to now priority has been given to enzymatic-gravimetric methods making possible the recording of soluble fibre as well. On an international scale the AOAC-method of separate isolation of both soluble and insoluble fibre has steadily gained importance. It is also recommended for food analysis in the GDR. Taking into account knowledge about the physiological effect of soluble dietary fibre the importance of methods revealing only insoluble fibre is decreasing (e.g. NDF-method). Procedures of total fibre detn. through monomers of fibre and lignin are labour expensive, but suitable and necessary for investigation made in fundamental research. International standardization of dietary fibre is urgently needed. An agreement has to be found between the demands of control and the physiological assessment of food. In the framework of such efforts aimed at the elaboration of regulations indigestible nutrients as well as potential fibre have to be taken into consideration. AS

## TOXICOLOGY

2274

Christie (GL) and Green (NR). **Isolated fiber components and pH alter methylazoxymethanol acetate mutagenicity.** *Journal of Food Protection* 52(6): 1989; 416-418, 426

Dietary fibers, 300  $\mu$ g of pectin, lignin, hemicellulose, or cellulose, were preincubated with either 1500  $\mu$ M, 1000  $\mu$ M, 750  $\mu$ M or 500  $\mu$ M of the mutagen methylazoxymethanol acetate (MAM acetate) at pH 5.4, 2.1 and 8.6 simulating gastrointestinal conditions. A modification of the Ames assay was used with *Salmonella typhimurium* his G46 and no S-9 activation to determine any change in mutagenic activity of MAM acetate with



and without the individual fiber components at each pH level. At pH 5.4 MAM acetate was only weakly mutagenic, therefore it was difficult to assess the effect of the fiber components. MAM acetate displayed the highest level of mutagenicity at pH 2.1. At pH 2.1 the % inhibition of MAM acetate induced revertants with pectin and hemicellulose was greater than 99%. Lignin caused 91% inhibition, but cellulose did not effectively inhibit mutagenicity. At pH 6.6 MAM acetate was mutagenic only with 1500 uM and 1000 uM concn. At pH 6.6 lignin and hemicellulose caused 99% inhibition, pectin 97% and cellulose 38%. The results indicate that the effect of dietary fiber on mutagenicity is dependent on the specific fiber components tested, and support the theory that inhibition of mutagenicity is due to binding of the mutagen with the fiber component. AS

2275

Sivaswamy (SN), Balachandran (B), Balanehr (S) and Sivaramakrishnan (VM). **Mutagenic activity of South Indian food items.** *Indian Journal of Experimental Biology* 29(8); 1991; 730-737

Twenty three items including snack foods, fruits, spices and their oils, edible oil, country liquor, and fish were screened for mutagenic activity in the *Salmonella typhimurium* by reverse mutation assay. Kesari powder, calamus oil, palm drink, toddy and kewra, salted sundried and oil fried white bait fish, seer fish and ribbon fish, and colouring agents were found to be mutagenic; garlic, palm oil, arrack, onion and pyrolysed portions of bread toast, chicory powder were weakly mutagenic, and tamarind, turmeric, decoction of cumin seed, aniseed and ginger were not mutagenic. SRA

2276

Osawa (T). **Mutagen formation in foods and its inhibition.** *Journal of Japanese Society for Food Science and Technology (Nippon Shokuhin Kogyo Gakkaishi)* 37(4); 1990; 311-319

2277

Kusumoto (K), Goto (T) and Manabe (M). **Evaluation of activity for conversion of sterigmatocystin to aflatoxin in koji-molds.** *Report of the National Food Research Institute (Japan)* 54(2); 1990; 14-17 (Ja)

2278

Goto (T). **Comparison of some immunological aflatoxin analysis methods.** *Report of the National Food Research Institute (Japan)* 54(2); 1990; 35-43 (Ja)

A simplified sample preparation method was developed for immunological aflatoxin analysis of maize. Maize and mixed feeds were extracted 2.5 times (v/w) with 80% methanol. Recovery of aflatoxins using this solvent was high and adequate for further immunological analysis. Using samples extracted by this method, five (5) commercially available aflatoxin analysis kits, Aflatest; May and Baker, TD100; Oxide, Afla 10 cup; IDS, Aflacheck UBE and Agriscreen; NEOGEN, were compared to determine their accuracy and practicality. The accuracy of these immunological methods were variable especially certain mixed feeds; however, these methods were achieved as simple aflatoxin analysis. AS

2279

Wongurai (A), Goto (T) and Manabe (M). **Cultivation condition and simple analysis method for the detection of aflatoxigenic fungi.** *Report of the National Food Research Institute (Japan)* 54(2); 1990; 53-57

The effects of 3 N sources,  $\text{NaNO}_3$ ,  $(\text{NH}_4)_2\text{SO}_4$  and yeast extract on the growth of aflatoxigenic fungi and the aflatoxin (AF) production were studied. The production of AF was greatest when yeast extract was used. No difference was observed between glucose and sucrose as the carbon source. Max. AF production was observed with 5% glucose and 1% yeast extract. The use of GY (glucose-yeast extract) medium resulted in higher levels of AF compared to the other media studied. Various liquid-liquid extraction methods were tested for the purpose of developing simple analytical method. The combination of methanol and chloroform was best as the extraction solvent for aflatoxin analysis. AS

2280

Muller (U), Blaas (W), Mehlitz (I), Vieths (S) and Weber (R). **Benzene and toluene in foodstuffs.** *Deutsche Lebensmittel-Rundschau* 86(9); 1990; 277-281 (De)

Food stored and sold (with and without newspapers and magazines) at fuel stations, food shops and new stalls were tested with simple analytical methods for aromatic hydrocarbons (benzene, toluene). Toluene contamination of the food was found in presence of printing products. Benzene was found in 15 of 177 samples. 4 of these samples contaminated with concn. between 20 and 53 p.p.b, while 11 samples were contaminated within the detection limit. BV

## FOOD LAWS AND REGULATIONS

Nil



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